Initial Conditions as Exogenous Factors in Spatial Explanation

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Summary of the Dissertation

This dissertation shows how initial conditions play a special role in the explanation of contingent and irregular outcomes, including, in the form of geographic context, the special case of uneven development in the social sciences. The dissertation develops a general theory of this role, recognizes its empirical limitations in the social sciences, and considers how it might be applied to the question of uneven development. The primary purpose of the dissertation is to identify and correct theoretical problems in the study of uneven development; it is not intended to be an empirical study.

Chapter 1 introduces the basic problem, and discusses why it has become especially salient in debates concerning uneven development.

Chapter 2 develops an argument for the importance of initial conditions in the philosophy of science, developed specifically in the context of the Bhaskar/Cartwright 'open systems' (and by extension, 'exogenous factor') emphasis on the ubiquity of contingency in the universe and rejection of explanation based on laws of nature (regularity accounts) of causation.

Chapter 3 makes three claims concerning the concept of contingency, especially as related to the study of society: 1) that there are eight distinct uses of the word contingency, and its many meanings are detrimental to clarity of discussion and thought in history and the social sciences; 2) that it is possible to impose some order on these different uses through developing a classification of contingency into three types based on assumptions concerning possible worlds and determinism; 3) that one of the classes is a special use of the word without relevance to the social sciences, while the two remaining classes are nothing more than a variety of the 'no hidden factors' argument in the debate on indeterminism and determinism (and thus related to the concept of spacetime trajectories caused by initial conditions and the interference of these in the form of 'exogenous factors' with 'open systems').

Chapter 4. The concept of explanation based on initial conditions together with laws of nature is widely associated with determinism. In the social sciences determinism has frequently been rejected due to the moral dilemmas it is perceived as presenting. Chapter 4 considers problems with this view.

Chapter 5 considers attitudes among geographers, economists, and historians towards using geographic factors as initial conditions in explanation and how they might acceptably be used, in particular their role in 'anchoring' aspatial theories of social processes to real-world distributions.

Chapter 6 considers the relationship of the statistical methods common in development studies with the trend towards integrating geographical factors into econometric development studies. It introduces the statistical argument on 'apparent populations' that arrives at conclusions concerning determinism consistent with Chapters 2 and 3 of the dissertation. The need for the visual interpretation of data with descriptive statistics and maps and their utility in the study of uneven development is discussed with a number of examples.

Chapter 7 applies these concepts to the 'institutions versus geography' debate in development studies, using Acemoglu, Johnson and Robinson's 2002 'reversal of fortune' argument as a primary example.

Chapter 8 considers possible directions for future work, both theoretical and empirical.

Chapter 9 concludes with a discussion of additional possible objections to the use of initial conditions as exogenous factors in explanation.

This dissertation is the result of my own unaided work and presents as original nothing which is the result of work undertaken in collaboration with others. The dissertation does not exceed 80,000 words.

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Prefatory Comments

Approaches to the study of uneven development based on Humean regularity accounts of causation (and frequentist statistics, discussed further in Chapter 6) have had limited success. This is not surprising given that local development outcomes are single incidences - there is only one East Asia, one Peru, one Silicon Valley.

In recent decades theories of singular or 'token' causation have been popular, and these might reasonably be expected to work better in the study of unique development outcomes. However, these approaches are also plagued by many unresolved contradictions and inconsistencies.[1]

One approach to the explanation of singular outcomes has been exceptionally important in recent decades in the philosophy of science as well as an important heterodox view in the social sciences. This is an essentialist, neo-Aristotelian 'natures' or 'capacities' view closely associated with Nancy Cartwright in both fields and Roy Bhaskar in the latter.[2]

There are two components to the Bhaskar/Cartwright argument. One is the rejection of regularity accounts of causation and laws of nature based on the problem of argument from induction. It is not possible to know for sure that laws of nature hold outside of the experiments scientists perform; in the real world of systems interfered with by exogenous factors (i.e., the real world of ubiquitous 'open' systems) we see things acting in non-lawlike ways. The second component is that, given that we cannot be sure that laws are operating in these cases, it is better to view the behavior of things we see in the real world as being due to their essential nature, capacities, or tendencies. Both of these components have been heavily criticized.

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[1] For a general overview and examples see Heathcote and Armstrong 1991, Hitchcock 1995, Armstrong 1997, Ch. 14, Ellis 2000, and Psillos 2002.

[2] Cartwright's argument has been highly influential in the philosophy of science, and she has directly applied it to the social sciences (especially economics, Cartwright 1999, 2002b) where it has also been increasingly influential (e.g., Hoover 2001, Kittel 2006). Bhaskar's views have long been associated with the study of uneven development and an emphasis on the contingency of local outcomes (e.g., Sayer 1984, Outhwaite 1987, Urry 1987 in the 1980s), a view which has become an increasingly prominent heterodox position in economics and the social sciences (in the 1990s to the present; e.g., Archer 1995, Steinmetz 1998, Fleetwood 1998, Sayer 2000, Danermark et. al. 2002; Patomäki 2002, Downward 2003, Van Bouwel 2003, Lawson 1997, 2003, Mearman 2004, Lewis 2004).

However, as evident in the continued attention to 'open systems' arguments, these critiques have not been entirely effective.

Chapter 2 of this thesis began as a novel critique of Bhaskar/Cartwright-type open systems arguments. While disagreeing with their conclusions, we believe that their views on the *importance* of ubiquitous contingency and the role of open systems/exogenous factors in explanation are correct and insightful. Nevertheless, our argument shows how, through recognizing the importance of the role of initial conditions in explanation, attention to the openness of systems and the ubiquity of contingency *strengthens* rather than weakens a traditional 'laws plus initial conditions' (L+IC) concept of explanation.[3]

Crucially, though, Chapter 2 does not have as its ultimate goal the rejection of the Bhaskar/Cartwright view of explanation. Although demonstrating the merit or lack of merit of their theory is important considering it is a major point of contention within the philosophy of science (and an increasingly prominent heterodox viewpoint in some social sciences) that is not our primary objective. The larger goal of Chapter 2 is as the first step towards the expression of a full theory of the explanation of contingent events (including location) based on the role of initial conditions (as exogenous factors) in shaping spatial distributions. Chapter 2 lays the groundwork for the future development of such a theory.

We want to make clear at the outset what our claims are and are not for the usefulness and originality of this theory. Part of the discussion in Chapter 2 is set in the context of a famous example by Otto Neurath cited by Cartwright concerning a banknote fluttering in the wind and what understanding of 'forces' one would need in order to explain the descent of the banknote. Our argument concerns the role of initial (and boundary) conditions in this type of scenario. An anonymous reviewer for the journal *Philosophy of Science*, reviewing an early draft of an article that now forms

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[3] We abbreviate a traditional 'laws plus initial conditions' concept of explanation as 'L+IC'. The concept of explaining using laws and initial conditions was formalized in the mid-twentieth century and became closely associated with Hempel and the 'deductive nomological' or 'D-N model'. We do not use the term 'D-N model' for several reasons. First, the basic concept of explaining relying on laws and initial conditions long predates the D-N model; second, the D-N model is somewhat of a 'loaded' term, associated with positivism, 'scientism', and other ideas that cause many social scientists to reject it out of hand; third, the term 'deductive-nomological' is unnecessarily confusing, whereas the idea of explaining using laws and initial conditions is conceptually straightforward. Finally, the emphasis on the importance of initial conditions is clear in the phrase 'L+IC concept of explanation', whereas a lack of attention to initial conditions, as we will argue, was precisely one of the chief problems with the 'D-N model'.

Chapter 2 of the dissertation, was not clear on precisely what our claim was regarding initial conditions and the wind in the Neurath-Cartwright example. They write 'As I understand it, there are three possibilities:

(a) The initial conditions include facts about the forces due to the wind.

(b) The initial conditions include facts that imply the existence of forces due to the wind.

(c) The initial conditions explain what the 'force of wind' was supposed to explain, and so no appeal to forces (other than gravity) is required.'

The reviewer correctly notes that neither (a) nor (b) would negate Cartwright's argument, and our paper does indeed argue for (c), i.e., a general theory that initial conditions explain the spatial irregularities of the universe and that this in turn resolves the problems associated with explaining contingent events. The reviewer continues:

> As for (c), it strikes me as either brilliant or crazy. It is crazy if we are supposed to believe that enough has been said to provide the explanation in question, or even how such an explanation would go, in principle. It is brilliant if it can be fleshed out into a full-blown explanation of how, for example, spatio-temporal irregularities can, without appeal to forces (other than the rarefied forces, such as gravity, that Cartwright is prepared to admit), explain the motions that would normally be explained by appeal to the force of the wind (or cognate notions, such as 'pressure'). But actual explanations in classical physics *do* appeal to such forces, so we are really talking about an entirely new theory (anonymous reviewer for *Philosophy of Science*).

We would demure that our theory is not 'brilliant', but also deny that it is 'crazy'. It is not brilliant as it is in some ways merely a description of what scientists do every day that simply has not been expressed clearly within the context of recent debates on explanation. However, it is not crazy for exactly the same reason. (Lest the reader, in light of the reviewer's comment, fear that we are proposing a theory based on some 'half-baked' argument that modern physics itself is somehow in error, we want to emphasize that our argument is precisely to the contrary. Our theory in no way relies on any argument that modern physics is somehow in error, but quite the opposite -

current theories of *explanation* are not sufficiently grounded in recent critical developments in *standard* physics/science.[4])

Furthermore, and again for the same reason, 'fleshing out' this argument into a 'full blown' theory is not nearly as daunting as the reviewer suggests. As we will discuss in Chapter 2, there are numerous and increasing examples of explanation in the sciences that already do what our theory says must be done. We merely point out that there has been an unrecognized degree of success (most stunningly in recent developments in quantum cosmology) using these methods since they were last explicitly debated in the early- to mid- twentieth century (largely under the rubric of 'D-N models' of explanation). Crucially, though, the full metaphysical and epistemological *import* of these successes has not been fully appreciated in the philosophy of science and explanation, and we set out to correct this situation.

It will become apparent that the concept of explanation we urge has severe epistemological limits (largely related to the problem of reductionism/emergent properties) for application to the social sciences. We make two comments regarding this fact. First, we believe it is important to have a *theoretically* correct concept of explanation regardless of what the implications of this are for the possibility of knowledge of certain domains. The world is not always to our liking, and far too often theories of 'explanation' in the social sciences seem to be based on desired ends rather than reality.[5] Second, and crucial to the second part of this thesis, is the belief that there *is* one use for our theory of explanation that is both tractable and indeed *essential* for the study of uneven development. We introduce this argument in the

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[4] As mentioned by Earman et. al. 2002 (286 and endnote 5), it is the Bhaskar/Cartwright argument that rests on an incorrect or incomplete understanding of standard physics, specifically confusion concerning the dynamic nature of differential equations, and, as Sheldon Smith clearly shows, that explanation of something like a falling banknote is perfectly theoretically possible under the standard view of physics using classical continuum mechanics (Smith 2001). Our argument is emphatically *not* opposed to standard modern interpretations of physics. Rather, it is based on observing patterns in modern successful scientific explanation, making explicit how this is being achieved, and applying these insights to new domains.

[5] As Rosenberg notes, the explanatory irreducibility of the human sciences is only epistemic, and 'there are good arguments available to show that metaphysical' reducibility is tenable (Rosenberg 2005, 18). Clearly, though, the type of society that could gather and process sufficient information to remotely begin to 'explain' or predict social processes would be extremely complex and most likely highly intrusive. Like many (e.g., economist Herman Daly and theologian John Cobb in their *For the Common Good*, 1989) we believe there are practical and moral reasons why it would be far better to voluntarily limit the complexity of society, which would likely preclude much social 'science'. We view the rise in 'happiness studies' in the social sciences, especially making measures of emotional well-being the goal of 'development' (Bruni and Luigi Porta 2005, Graham 2005), as a step in the right direction towards meaningful, sustainable, and *pragmatic* uses for the social sciences.

Introduction (Chapter 1) and develop it further in the context of the social sciences in Chapter 5. Chapter 6 considers methodological issues regarding this application, and Chapter 7 is an example of applying this approach to the explanation of (contingent) uneven development outcomes.

There are frequent and occasionally extended quotations in Chapters 1-4 of the dissertation. These are not the result of laziness; their presence is part of a purposeful approach to the subjects discussed. A major point of this dissertation is to show that there are certain perspectives that are widespread in the social sciences, and that there are problems with these perspectives. The use of quotations is meant to both document precisely the views on the subjects we discuss and to avoid the all too frequent charges of misrepresentation that plague sometimes heated exchanges (such as Anderson 2001 and Cartwright 2001 regarding the subject of Chapter 2). Chapter 1 uses frequent quotations to demonstrate the existence of certain views concerning initial conditions and the use of geographic factors in economics, Chapter 3 to demonstrate the degree of confusion concerning the concept of 'contingency', and Chapter 4 to demonstrate certain beliefs regarding determinism in the social sciences.

Chapter 2 is closely adapted from the previously published article 'Initial Conditions and the "Open Systems" Argument against Laws of Nature' (Ballinger 2008). Appendix B is the result of early attempts to transform work from the M.A. thesis into the doctoral dissertation; obstacles to doing so resulted in the investigations leading to the present work. This early work is included in Appendix B as it both lends depth and context to some of the discussions in the second part of the present work, and because, although earlier work, it also serves as an example of possible directions for future empirical research.

CHAPTER 1
INTRODUCTION

This dissertation shows how initial conditions play a special role in the explanation of contingent and irregular outcomes, including (in the form of geographic context) the special case of uneven development in the social sciences. The dissertation develops a general theory of this role, recognizes its empirical limitations in the social sciences, and considers how it might be applied to the question of uneven development. The primary purpose of the dissertation is to identify and correct theoretical problems in the study of uneven development; it is not intended to be an empirical study.

The key questions the dissertation seeks to address:

- What is the role of initial conditions in explanation?
- How does recognizing this role alter common conceptions of explanation?
- What are the empirical limitations to this view of explanation?
- How is this view of initial conditions related to spatial distributions and the concept of 'contingency'?
- Does the relation between initial conditions and spatial distributions in the hard sciences hold in the social sciences? If so, can it be applied to the far more complex social sciences, and how?
- Overall, can a better philosophy of science understanding of the role of initial conditions, including 'initial conditions' in the form of geographic factors and factor endowments in the social sciences, help improve our understanding of uneven development?

1.1 The Neglected Role of Initial Conditions

Initial conditions (and the related concepts of boundary and antecedent conditions[6]) have received relatively little discussion in the philosophy of science. To

[6] Technically, references to 'initial conditions' other than in the context of cosmology are actually references to 'antecedent conditions'. When some system is under study, the realm of study is demarcated temporally and spatially by antecedent and boundary conditions respectively.

initiate discussion of several important issues concerning initial conditions, including why they have not received more attention, the common analogy of a billiard table with many balls on it is useful. Under determinism, the movement of all the balls on a billiard table will be determined by the laws of nature along with the initial velocity (speed and trajectory) of the first ball and initial placement of all the other balls, the 'initial conditions' of the table. Consequently on various billiard tables, given the same laws of nature, it is the difference in initial conditions that will account for the different final distribution of balls on each table. A theoretical relationship between initial conditions and spatial distribution is evident in this example.

From the Enlightenment until the twentieth century deterministic assumptions were not uncommon, and therefore it might seem that the role of initial conditions in the sciences would have been an important area of study. However, despite the apparent importance of initial conditions under determinism, in discussions of the philosophy of science and explanation the search for laws of nature dominated this time period (evident in the fame of the discoveries of Boyle, Newton, Maxwell and others associated with laws of nature) while consideration of the role of initial conditions was relatively limited.

The twentieth century witnessed the development of an indeterministic consensus (Hacking 1983) which in turn relegated initial conditions to a still lower status. The reason is evident if we imagine the billiard table again, but this time as indeterministic. On this table when balls collide they do not always follow the laws of our previous tables. Rather, they often veer off in directions that would have been 'wrong' on the deterministic table. If one wanted to know, after the initial first push of a ball, where all the balls on the table would end up, on the indeterministic table the initial conditions would be a great deal less important than under determinism (how much less would depend on the degree of indeterminism of the table, and the time passed and hence number of interactions). The accumulating indeterministic interactions would increasingly diminish any influence from initial conditions.

Thus between the early focus on laws of nature and the later rise of indeterministic assumptions, the role of initial conditions in the philosophy of science has seldom been the object of extended consideration. Wilson (1991), discussing boundary conditions, summarizes the level of attention to initial and boundary conditions: '[T]he standard philosophy text says virtually nothing about boundary conditions – they are scarcely mentioned before they are packed off in an undifferentiated crate

labeled "initial and boundary conditions" (usually pronounced as one word). The salient fact about "initialandboundaryconditions" is that, whatever else they may be, they are not laws and can be safely ignored' (Wilson 1991, 565). Even when initial conditions are occasionally recognized as important, precisely how and why seldom seems to be pursued. For example, in their discussion of inflationary cosmology Earman and Mosterin state that '[t]hese issues about the nature of scientific explanation and the role of initial/boundary conditions are well worth pursuing, but we will not do so here' (1999, 20). In fact, few others have pursued this issue (discussed further in Chapter 2 below).

1.2 Initial Conditions in the Social Realm

In discussions of uneven economic development initial conditions, if discussed at all, are generally equated with the antecedent geographical or environmental[7] context within which social development occurred.[8] References to 'initial biogeographic endowments' (Olsson and Hibbs 2000, 1) and 'initial conditions including initial population, climate, geography, and natural resources' (Berkowitz and Clay 2004, 18) are common.

The idea that geographic factors influence the social realm has frequently been rejected since the mid-twentieth century (see Chapters 4 and 5 for further discussion). Yet when the origins of spatial patterns of social variation have been considered since that time period there have been important cases where these are attributed to initial conditions in the form of geographic factors. For example, economic historian Douglass North discusses cultural differences that 'emerged primarily from the diverse geographic experiences of groups contending with their environments and evolved into different languages, religions, customs, and traditions' (1982, 209). Among geographers, too, and despite deeply held concerns with environmental

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[7] I.e., 'environmental' in the popular sense of large-scale 'natural' factors, such as weather. We will shorten the phrase 'geographic and environmental factors' to 'geographic factors' in the interest of space.

[8] 'Initial conditions' usually refers to early, slow moving 'fundamental' variables in the development literature. Sometimes the term is used to refer to early institutional patterns such as patterns of colonization or early levels of development. Frequently, however, even these non-geographic 'initial conditions' are considered to be preceded and shaped by geographic factors, whether or not these are considered causal in later outcomes (e.g., Krugman 1998, Woods 2004, Masanjala and Papageorgiou 2006).

determinism in the discipline, one finds similar statements. Carl Sauer states that 'The culture area, as a community with a way of living, is therefore a growth on a particular "soil" or home, an historical and geographical expression. Its mode of living, economy, or *Wirtschaft*, is its way of maximizing the satisfactions it seeks and of minimizing the efforts it expends. That is perhaps what adaptation to environment means' (Sauer 1940). Richard Hartshorne likewise sees the question of the development from simple initial conditions to modern social complexity as a central question of geography; 'In no small part, the ultimate goal of geography is to provide scientific description of the way in which the originally unorganized areas of the earth are organized into various kinds of functioning regions' (Hartshorne 1960, 53).

1.2.1 Initial conditions in recent studies of uneven development

In the past decade there has been a substantial increase in the integration of geographic and environmental factors into explanations of uneven development (e.g., Diamond 1997, Gallup, Sachs and Mellinger 1998, Acemoglu, Johnson and Robinson 2001, 2002, 2005, Easterly and Levine 2003, Rodrik, Subramanian and Trebbi 2002). This represents a significant divergence from long-held views on the place of geographic and environmental factors in explaining social outcomes in the social sciences, where geographic factors have often been rejected because of their association with determinism and as 'ultimate causes'. Despite these concerns geographic factors in the guise of initial conditions have increasingly been integrated into development studies. For example, economist Oded Galor recently writes:

> Variations in the economic performance across countries and regions reflect initial differences in geographical factors and historical accidents and their manifestation in variations in institutional, demographic, and cultural factors, trade patterns, colonial status, and public policy. (Galor 2005, 4)

Similarly, economic historian Kenneth Sokoloff writes:

> With evidence of wide disparities even among economies of the same European heritage, scholars have begun to reexamine alternative sources of diversity in experience, such as factor endowment. Because economists traditionally emphasize the pervasive influence of factor endowment, the qualitative thrust of

> this approach may not be entirely novel (Baldwin 1956; Domar 1970; Lewis 1955). What is new, however, is the focus on how initial conditions—factor endowments, broadly conceived—could have had profound and enduring impacts on the extent of inequality and ultimately the long-term paths of institutional and economic development in different countries. (Sokoloff 2000, 3; published in similar form as Sokoloff and Engerman 2000)

Views similar to this have become increasingly common:

> Once initial conditions are given, in the absence of shocks, long-run relative growth rates evolve in a deterministic fashion (Setterfield 1997, 371)

And:

> Theories such as Azariadis and Drazen (1990) suggest that countries that are identical in their structural characteristics but differ in initial conditions may cluster around different steady state equilibria in the presence of increasing returns to scale from some factor of production, market imperfections, non-convexities in the production function, etc. In other words, the introduction of initial conditions…may lead to the emergence of club convergence (see Galor (1996)). These considerations suggest that if we index the countries by an interesting dimension such as initial conditions then, near steady state, the Solow model can provide a good approximation for countries with similar initial conditions. (Kourtellos 2004, 3-4)

And:

> Could the observed divergence in long-run economic performance across countries be attributed to differences in initial conditions? If so, can these initial differences be adequately characterized by a small set of variables? (Tan 2003, 5)

Other similar observations concerning initial conditions can be found in the recent literature on economic growth.[9]

Despite the prominence of past objections to geographic influence on society due the perception of geography as an 'ultimate' and deterministic cause, geographic factors in the guise of initial conditions have not just been increasingly integrated into development studies, but precisely as 'ultimate causes' or 'fundamental determinants of growth'. Recent studies of uneven development incorporate geographic factors not only as a short-term influence (such as the seasonal impact of frost on agriculture) but also as slow moving factors or initial conditions that have strongly shaped development outcomes. Tan explains this idea:

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[9] Further examples include Setterfield 2001 which states: 'It seems, then, that the *core* of the cumulative causation process, as it is found in *both* "formal" models *and* in Kaldor, involves unambiguously self reinforcing change that can be associated with a specific set of initial conditions' (109, emphasis in the original) and Masanjala and Papageorgiou who find that

> initial conditions at colonial independence…exerted a significant impact on Africa's post-colonial economic performance. This has been doubly magnified by Africa's geography. While not arguing for geographical determinism, we have demonstrated that Africa's peculiar geography and ecological environment, impacted the nature, timing and duration of colonial relationships with European countries. Consequently, the impact of initial conditions and colonialism on post-colonial economic performance in Africa are different from that in other regions. (Masanjala and Papageorgiou 2006, 10-11).

Similarly, Nugent and Robinson ask 'Are Endowments Fate?' (the title of their [2002]; Barham et. al. [2000] is likewise titled 'Are Endowments Fate? An Econometric Analysis of Multiple Asset Accumulation in a Biodiverse Environment', although the question is addressed in a microeconomic setting). Former World Bank economist William Easterly and colleagues have recently even explored the question 'Was the Wealth of Nations Determined in 1000 B.C.? (Easterly et. al. 2007).

> The recent empirical growth literature has built upon [neoclassical growth] work by recasting the growth process within a system that exhibits a 'hierarchy of timescales' whereby slower-moving variables determine the evolution of faster-moving variables. In this view, the familiar neoclassical determinants of growth described above constitute only the 'proximate' determinants of growth. These proximate factors are themselves posited to be determined by slow-moving variables such as a country's geography, the quality of its institutions, and the degree of fractionalization (both ethnic and religious) in its society. These latter 'fundamental determinants' are seen to govern the evolution of proximate variables by shaping the incentives and constraints that influence family planning, saving, and schooling decisions. (Tan 2005, 1)[10]

Given the long-standing rejection of the use of geographic factors in arguments about social outcomes, why have these factors somewhat suddenly and forcefully reappeared in development studies? Recent developments in development economics help in answering this question and illustrate why we believe the role of initial conditions as exogenous factors are important for the social science study of uneven development.

1.3 Initial Conditions as Geographic Factors: Why they have Reappeared in Development Studies

As economists and others closely involved with international development agencies have made clear in recent years, despite many different approaches one policy after another has resulted in little economic gain and frequently caused

[10] One possibly important *spatial* aspect of slow moving 'deep' factors such as geography to the development of variation in social outcomes is the *difference* in the time scale of change between geographic factors and social systems. As Tan explains, 'Brock (2001) points out that a generic property of slow-fast dynamic systems is that the slow variables act as bifurcators to the dynamics of the fast variables…An example is Holling's Textural Discontinuity Hypothesis (see, Holling (1992)) which posits that slow-moving variables like the ecological landscape determine the distribution of faster-moving variables like the body sizes of creatures' (Tan 2005, 4).

negative unintended consequences.[11] Crucially, this has led to a greatly increased openness to factors long ignored as 'exogenous' in development theory in the attempt to more fully capture the range of variation in factors thought relevant to development across the globe. Subsequently, datasets have grown dramatically in scale and scope in the past two decades, covering much of the globe and such diverse factors as measures of institutions and political systems,[12] corruption,[13] norms and beliefs,[14] ethnolinguistic fractionalization,[15] and geographical factors relevant to development.[16] Additionally, factors thought to have long-term effects on development, such as colonial history, historical urbanization and population, migration, disease, and historical patterns of trade have also been increasingly quantified in cross-national datasets.[17] However, as ever more social factors such as measures of culture, education, ethnic fractionalization, religion and so on are included in development studies a paradox becomes evident. If *everything* is endogenous, how can anything be treated as an explanatory independent variable? This problem was recently explicitly recognized by the political scientist Adam Przeworski:

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[11] Making many of these critiques especially forceful is the fact that they come from 'insiders' such as Joseph Stiglitz's (2000) 'What I Learned at the World Economic Crisis' and William Easterly's (2001) *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics*, or those with otherwise 'progressive' views not inherently skeptical of government aid (a predisposition which sometimes undermined the force of the arguments of past critics of international aid) such as Maggie Black's (2002) excellent *The No-Nonsense Guide to International Development*.

[12] E.g., *Governance Matters III: Governance Indicators for 1996-2002*, (World Bank), *Polity IV Dataset*, (University of Maryland).

[13] E.g., *Corruption Perception Index*, (Transparency International).

[14] E.g., *World Values Survey 1981-2004*, (World Values Survey Association).

[15] *Ethnolinguistic Fractionalization Indices*, (Roeder, 2001).

[16] Extensive geographical datasets related to development have been especially associated with work from the Center for International Development (CID) at Harvard University. Examples include Mellinger, Sachs, and Gallup (1999) 'Climate, Water Navigability, and Economic Development', Masters and McMillan (2000) 'Climate and Scale in Economic Growth', as well as Gallup, Sachs, and Mellinger (1998) 'Geography and Economic Development', and Masters (2003) 'Climate, Agriculture and Economic Development', in *Land Quality, Agricultural Productivity, and Food Scarcity*.

[17] Extensive datasets have been developed using historical data from Angus Maddison's *Monitoring the World Economy*: 1820-1992 (OECD, 1995) and *The World Economy: A Millennial Perspective* (OECD, 2001) as well as research by Philip Curtin, Paul Bairoch and other demographic historians. These have been most notably used in the trilogy of highly influential works by Acemoglu, Johnson, and Robinson (and the numerous responses generated by this research): 'The Colonial Origins of Comparative Development: An Empirical Investigation' (2001, *American Economic Review*), 'Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution' (2002, *Quarterly Journal of Economics*), and 'The Rise of Europe: Atlantic Trade, Institutional Change and Economic Growth' (2005, *American Economic Review*).

> The recent theoretical developments [in development studies] consist of endogenizing factors previously considered as exogenous (Acemoglu and Robinson 2001, Banerjee and Duflo 2003, Benabou 1997, 2000, Benhabib and Przeworski 2004, Bourgignon and Verdier 2000, Hoff and Stiglitz 2003, Perotti 1993, Saint Paul and Verdier 1996): inequality shapes institutions, institutions affect redistribution, both institutions and income distribution influence the growth of income, while the level of income affects both institutions and inequality. Yet if everything is endogenous, identification is impossible: everything is simply determined by the initial conditions, which may, in turn, be shaped only by geography. (Przeworski 2004, 20-21)

The sharp increase in observations that initial conditions are needed in development studies suggests that Przeworski may be correct that the trend to endogenize every conceivable factor has ended in a paradox of 'circular endogeneity'.[18]

Crucially, this circular endogeneity not only presents a problem for identification in econometric models but also for explaining the inherently *spatial* component of the question of uneven development. Many theories of uneven development such as core-periphery theories or theories of industrial agglomeration posit some process that causes more agglomeration or development in one area and less in another. These seem to offer insights into the process of development. But there is a certain circularity to all arguments of this nature unless they also offer an explanation for why an agglomeration or 'core' is located where it is. For example, in core-periphery theory, why was the historical core not centered over Eastern rather than Western Europe? Or over Tajikistan or Mali for that matter? Europe could just as easily be the periphery to an Inner Asian or African core as the other way around. Core-periphery theories might explain complex relations between core and periphery, but only after assuming the core is where it is in the real world. They must ultimately address the location of the core to meaningfully explain real spatial distributions of development. More recent, subtler theories of agglomeration may appear to overcome this problem

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[18] Note that the same problem has been simultaneously recognized in modelling in urban studies: 'The problem one quickly faces in developing a simulation model of urban dynamics is that almost everything seems to be endogenous. Household location choices, firm location choices, real estate development choices, and governmental infrastructure and public service choices all interact dynamically.' (Waddell 2005, 1).

when they show how local economies are where they are because of influence from local institutions or culture. However, these studies only push the question of real world location onto other social factors. Why, then, is *that* local set of institutions or culture distributed as it is in the real world? A.J. Scott recognized this problem in the context of theories of high-tech clusters or agglomerations:

> there can be no invocation of a privileged 'independent variable' in the form of some prior fixed set of local activities or attributes…which are supposed to anchor the entire locational process within a more durable spatial matrix. Such a procedure would in any case only pose the problem again: What then accounts for the geographical pattern of *these* activities and attributes? (Scott 1984, 25)

Peter Hall notes critically that this agglomeration-type of explanation of uneven development (note the similarity to Przeworski's observation on 'circular endogeneity' above) 'somehow lacks a first cause; it goes endlessly on, reproducing itself, but there is no suggestion as to the origins of change, either in the system itself or in its locational expression' (Hall 1998, 295). Crucially, it seems that for explanations of *uneven* development to avoid circularity they cannot simply be made up of inherently *aspatial* and *endogenous* variables. They need *inherently spatial*, independent or *exogenous* factors to avoid circularity.

Krugman links the concept of exogenous geography and 'anchoring' in a clear statement of the idea:

> in many cases, aspects of natural geography are able to matter so much not because natural features of the landscape are that crucial, but because they establish seeds around which self-reinforcing agglomerations crystallize. So it is precisely the aspects of the economy that in principle allow history-dependent, multiple equilibria stories to be told that in practice give exogenous geography such a strong role (Krugman 1998, 24).

The idea of initial conditions as both exogenous and geographic factors[19] is clear in Krugman's quote and in other recent work. For example:

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[19] Out of three important factors often considered in development studies- trade, geography and institutions- 'Geography is arguably the only exogenous factor' (Rodrik 2003, 7) and 'Geography is as exogenous a determinant as an economist can ever hope to get' (Rodrik et. al, 2002, 2).

> The argument made in this paper is that exogenous geography and initial biogeographic endowments- and the diverging historical paths that these give rise to- in fact account for a significant part of the highly unequal distribution of productive income in the world. (Olsson and Hibbs 2000, 1)

Initial conditions in the form of geographic factors have become more common as more and more social factors have been integrated into the study of uneven development and the problem of circular endogeneity and the need for 'anchoring' has become more apparent. However, given the long history of ignoring initial conditions in the philosophy of science, it is not clear how to integrate initial conditions into the study of spatial distributions in general. Similarly, given that geographic and long-term environmental factors have long been taboo in the social sciences, there is very little recent debate on how these factors might be integrated into the study of uneven development. Their integration has already been marked by controversy (Blaut 2000, Sluyter 2003). Are the social sciences destined to simply repeat past debates on the use of geographic factors? The overarching argument of this dissertation is that a better philosophy of science understanding of the role of initial conditions can help in understanding their significance in explaining spatial distributions, including 'initial conditions' in the form of geographic factors and factor endowments in the social sciences.

1.4 Outline of the Rest of the Dissertation

Chapter 2 develops an argument for the importance of initial conditions in the philosophy of science. The argument is developed specifically in the context of Cartwright's 'open systems' rejection of regularity accounts of explanation. However, its larger purpose is the eventual development of a full theory of the explanation of contingent outcomes.

Chapter 3. The 'open systems' argument against laws of nature can be viewed as an emphasis on the ubiquity of contingency in the universe. There is also frequent invocation of the concept of 'contingency' in discussions of location and uneven development. Thus the concept of contingency is central to both the philosophy of science and applied sections of our theory. However, we find the term 'contingency' to be exceptionally poorly defined, especially in the social sciences. The purpose of

Chapter 3 is to attempt to better understand the meaning of the word ‘contingency’, and it develops a classification system to allow for clearer discussion of the term.

Chapter 4. Finally, the concept of explanation based on laws of nature together with initial conditions is widely associated with determinism. In the social sciences determinism has frequently been rejected due to the moral dilemmas it is perceived as presenting. Chapter 4 considers this problem in greater detail.

The remainder of the dissertation considers the role of initial conditions as exogenous factors in the study of uneven development.

Chapter 5 considers in greater detail attitudes among geographers, economists, and historians towards geographic factors and how they might acceptably be used, in particular their role in ‘anchoring’ aspatial theories of social processes to real world distributions.

Chapter 6 considers the relationship of the statistical methods common to development studies with the trend towards integrating geographical factors in econometric development studies. It introduces the statistical argument on ‘apparent populations’ that arrives at conclusions concerning determinism consilient with earlier chapters of the dissertation. The need for the visual interpretation of descriptive statistics and their proper use is discussed with a number of examples.

Chapters 7 is concerned with beginning the process of integrating spatial data into social theory based on the methods discussed in Chapter 6. Chapter 8 considers future work, both theoretical and empirical. Chapter 9 concludes with a discussion of some further implications and objections to an emphasis on initial conditions in a laws plus initial conditions (L+IC) concept of explanation.

CHAPTER 2
INITIAL CONDITIONS, SPATIAL IRREGULARITIES, AND 'OPEN SYSTEMS'

2.1 Introduction

The real world is highly complex. Indeed, it seems so complex that it is difficult to imagine that a handful of laws of nature can account for the many 'messy' and 'contingent' occurrences in the world. An emphasis on the ubiquity of contingency is at the heart of 'open systems' arguments that have been influential in recent decades in the philosophy of science as well as an important heterodox view in the social sciences. They are closely associated with Nancy Cartwright in both fields and Roy Bhaskar in the latter.[20]

Both Cartwright and Bhaskar emphasize the complexity of the world and doubt that a handful of universal laws can account for it. For example, Bhaskar sees

> A world of winds and seas, in which ink bottles get knocked over and doors pushed open, in which dogs bark and children play; a criss-cross world of zebras and zebra-crossings, cricket matches and games of chess, meteorites and logic classes, assembly lines and deep sea turtles, soil erosion and river banks bursting. Now none of this is described by any laws of nature. More shockingly perhaps none of it seems even governed by them. (Bhaskar 1975, 105)

Cartwright also rejects the possibility of subsuming the complex world under one theoretical structure of universal laws, and chooses a poem strikingly similar to the passage from Bhaskar to express her view of the world (Gerard Manley Hopkins in Cartwright 1999, 19):

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[20] Cartwright has been particularly successful in branding the belief in universal laws of nature as 'fundamentalist'; in the philosophy of science her work especially has attracted numerous counterarguments, e.g., Kline and Matheson 1986, Poland 1994, Anderson 2001, Sklar 2003, Spurrett 2001, Hoefer 2003, Psillos 2006. For the sake of brevity we will focus primarily on her work for most of the chapter.

Glory be to God for dappled things—
For skies of couple-colour as a brindled cow;
For rose-moles all in stipple upon trout that swim;
Fresh-firecoal chestnut-falls; finches' wings;
Landscape plotted and pieced – fold, fallow, and plough;
And all trades, their gear and tackle trim.
All things counter, original, spare, strange;
Whatever is fickle, freckled (who knows how?)
With swift, slow, sweet, sour, adazzle, dim;
He fathers-forth whose beauty is past change:
Praise him.

There are two components to the Bhaskar/Cartwright argument. One is the rejection of regularity accounts of causation and laws of nature based on the problem of argument from induction. It is not possible to know for sure that laws of nature hold outside of the experiments scientists perform; in the real world of systems interfered with by exogenous factors (i.e., the real world of ubiquitous 'open' systems marked by contingent change) we see things acting in non-lawlike ways. The second component is that, given that we cannot be sure that laws are operating in these cases, it is better to view the behavior of things we see in the real world as being due to their essential nature, capacities, or tendencies.[21] Both of these components have been heavily criticized. However, despite the numerous attacks on open-systems arguments, they have been resilient; as evident in the continued and even increasing

[21] Bhaskar generally uses the term 'tendencies' and Cartwright 'capacities'. Cartwright and others sometimes distinguish between 'natures', 'tendencies', and 'capacities' (e.g., Schmidt-Petri, forthcoming); if correct, my argument preempts the need for these distinctions. Note also that Cartwright writes 'My use of the terms *capacity* and *nature* are closely related. Most of my arguments about capacities could have been put in terms of natures had I recognised soon enough how similar capacities, as I see them, are to Aristotelian natures' (Cartwright 1999, 84-85).

The similarities between Bhaskar and Cartwright are not only apparent in their shared belief that the world is too complex for laws of nature, but also in the way they define what they mean by natures and capacities in a similar way. Bhaskar writes:

> The real basis of causal laws are provided by the generative mechanisms of nature. Such generative mechanisms are, it is argued, nothing other than the ways of acting of things…Tendencies may be regarded as powers or liabilities of a thing which may be exercised without being manifest in any particular outcome. (Bhaskar 1975, 14)

Cartwright defines her view of capacities by quoting from Gilbert Ryle's philosophy of the mind; capacities 'signify abilities, tendencies, propensities to do, not things of one unique kind, but things of lots of different kinds' (Ryle in Cartwright 1999, 64).

attention to 'open systems' arguments, these critiques have not been entirely effective. In a 1999 article Earman and Roberts even profess that they 'do not know how to begin to assess Cartwright's claim about context-specific factors that in principle elude theoretical treatment' (Earman and Roberts 1999, 456).

Crucially, most of the critiques of open system arguments (including more recent critiques) are focused on laws themselves in one way or another. Their effectiveness has been limited because, while they do support a general 'faith' in 'fundamentalism' they do not strike at the *root* of open-systems arguments. Our critique differs from previous critiques by not focusing on laws themselves, but rather on the inference from open systems to 'anti-fundamentalism' (i.e., in Cartwright's terminology, the rejection of laws of nature) and the importance of initial conditions to this inference.[22]

2.2 The Open Systems Dilemma

The first component of open-systems arguments is that there is no way to know if there are laws of nature because in the real world of open systems we rarely (outside of human-engineered experimental setups) see constant conjunctions between cause and effect. Rather than reason from induction to laws of nature, they argue, it is better to understand the behavior of things in the real world as due to 'natures' or 'capacities'. The obvious response to the first component of this argument is that in the real world of open systems we are seeing the effects of exogenous factors. We control for these in our engineered closed systems precisely so we can see laws without interference. In the real world, we can then combine the various laws to account for what we really do observe.

Open systems arguments generally reject this common response on the grounds that it is caught in the twin horns of a dilemma. The first horn is that there is no

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[22] Some of the points briefly raised in Earman, Roberts, and Smith 2002 come closest to our argument. They criticize Lange 1993, who presents an argument on 'provisos' (i.e., *ceteris paribus* statements) similar to the position of Cartwright, for inattention to boundary conditions (Earman, Roberts, and Smith 2002, 284) and argue that Cartwright confuses laws and differential equations of motion while neglecting initial conditions (286 and endnote 5). Otherwise, to our knowledge there has been little sustained attention to the importance of initial conditions to the open system argument. Bhaskar 1975 does discuss initial conditions towards its conclusion (236-237); however, by that point the discussion is entirely within terms of his 'transcendental realist' argument. Cartwright mentions initial conditions in scattered remarks; again we find no passage that clearly addresses our concerns. A point similar to part of our argument on systems is made by Ruphy (2003), particularly when she asks Cartwright how theoretical domains are to be divided into 'bits and pieces' (61).

principled way from within a theory to know what to control for to get a law – we would in effect need more general laws or theories to justify the external conditions we impose on an experiment for it to create constant conjunction outcomes. For example, Cartwright states 'My conclusion…is that we need to add to the basic "equations of motion", like F=ma or Schrödinger's equation, a special constraining condition: The equation holds so long as everything that can affect the targeted effect is describable *in the theory*' (Cartwright 2002a, 432-433; emphasis added. See also Bhaskar 1975, 12-13) and:

> All that is law-like on the Humean picture are associations between measurable quantities. That's it. The only way a condition could restrict the range of an association in a principled or nomological way would be via a more complex law…The effect of this is to move the conditioning factor C inside the scope of the law… (Cartwright 1999, 138)

As Cartwright continues, it is clear that she is saying that the irregularities we see in the real world must, for the fundamentalist, somehow be subsumed under more general laws: The 'account of laws as regularities goes naturally with a covering law theory of prediction and explanation. One set of regularities – the more concrete or phenomenological – is explained by deducing them from another set of regularities – the more general and fundamental' (Cartwright 1999, 138).

The second horn of the dilemma, because of its obvious nature more often implied that stated, is that the idea that there can be regularities explaining regularities in an infinite regress ('turtles all the way down') is illogical. For example, Cartwright states that 'As I urged in chapter 4, the alternative theory of explanation in terms of natures rejects the covering law account. *You can not have regularities "all the way down"'* (Cartwright 1999, 138; emphasis added).

2.3 Cartwright's 'St. Stephen's Square' Example

The way in which open-systemists depict the 'fundamentalist' as needing to subsume deviances from universal laws under more general laws (such as Galileo's constant acceleration and Kepler's imperfect ellipses subsumed under Newton's

laws)[23] is especially clear in Cartwright's 'St. Stephen's Square' example. This is one of the simplest examples Cartwright uses to illustrate her ideas, based on an example by Neurath of a thousand dollar bill falling in Vienna's Saint Stephen's Square on a windy day. (Due to its relative clarity Cartwright's commitments are particularly evident in this example, which is likely why it is frequently used against Cartwright e.g., in Spurrett 1999, Smith 2001, and Hoefer 2003, although for somewhat different reasons than here.) We consider this example in some detail to make clear Cartwright's depiction of fundamentalist explanation and its flaws.

Unlike a compact sphere in a vacuum, which will follow Newton's second law (gravity providing the force), it is impossible to know how the banknote will fall on a windy day. In the words of Hoefer:

> Does this falsify [Newton's] second law? Of course not, says the fundamentalist: the bill's deviation from a free-fall trajectory is explained by *other forces* on it (the wind and air resistance). But where, asks Cartwright, *in physics* does one get the wind forces from? The answer is: nowhere, because physics tells us practically nothing about wind or how it affects floppy paper objects. (Hoefer 2003, 1406)

Cartwright rejects a faith in a universal law of nature, F=ma, because in the real world we observe something other than F=ma. Crucially, she depicts the fundamentalist as believing there is a need for the path of the banknote to be described entirely by laws of physics. Her view is summarized by Hoefer:

> To hold that the second law is true in this case, you have to assume on faith that if one back-calculates the forces necessary to produce the motions of the bill correctly, assuming the second law and subtracting the force of gravity, then (a) the forces you calculate really did exist, on the bill, as it fluttered around; and (b) *those forces are in principle derivable from other fundamental physical laws (QM, perhaps)*. This is an awfully big thing to take on faith, Cartwright thinks. (Hoefer 2003, 1406; emphasis added)

In the words of Cartwright:

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[23] Other examples include the unification of Charles' law and Boyle's law under the Ideal Gas law and Maxwell's unification of theories of electro-magnetism and optics.

> Many will continue to feel that the wind and other exogenous factors must produce a force…That view begs the question. When we have a good-fitting molecular model for the wind, and we have in our theory (either by composition from old principles or by the admission of new principles) systematic rules that assign force functions to the models, and the force functions assigned predict exactly the right motions, then we will have good scientific reason to maintain that the wind operates via a force. Otherwise the assumption is another expression of fundamentalist faith. (Cartwright 1999, 28)

This idea that we explain through subsuming deviations from laws under more general laws is not unique to Cartwright, indeed it is widespread. According to Halonen and Hintikka, 'It seems to be generally believed among philosophers that to explain something is to subsume it under a generalization' (2005, 57).

If, however, we restate the open systems argument in different language, it seems peculiar. Consider the banknote example again. We have an explanandum: Why is the banknote falling as it is, rather than following Newton's Second Law, F=ma? (Or to recast it in predictive terms: Where will the banknote land in St. Stephen's Square?) An explanans of F=ma is rejected by Cartwright, as Hoefer emphasizes, because we have no way within the laws of physics to account for the wind as a force as stressed in Cartwright's quote (1999, 28) above; the problem is posed as a problem of the composition of forces.

But why should the wind be a *force* to be part of our explanation? 'Air' – i.e. atoms of nitrogen, oxygen, argon etc. – does seem to behave according to something like laws of nature (e.g., gas laws). But 'wind' – i.e. variations in the real-world temperatures and pressures and thus flow of masses of air – is a *condition of spatiotemporal irregularities in a particular part of the universe*. The question of 'wind' is *not* one of laws, but of how such *spatial* irregularities in the Earth's air came to be.

Crucially, this is where initial conditions play an indispensable but frequently ignored role. As we will show below, they are crucial for understanding where the spatial irregularities of the universe come from. Irregularities, in turn, are crucial to the concept of 'system', compelling both the anthropocentric idealization of 'systems' (such as a banknote falling in a city plaza) and their arbitrarily demarcated 'exogenous' factors (such as separating the 'wind' from the 'system' of a city square).

Our position boils down to the argument that through using laws *with initial conditions* we can in essence 'explain the wind' (that is, we can account for the spatial irregularities in the universe) which is in turn tantamount to explaining what humans perceive of as 'systems' and their 'exogenous factors'. We will first consider in the next section how initial and antecedent conditions account for the irregularities in the universe. In Section 2.5 we then discuss how irregularities account for what humans perceive as 'exogenous factors' and 'systems'.

2.4 'Explaining the Wind': Initial Conditions and Irregularities in the Universe

Even to the most ardent supporters of universal laws of nature, such as proponents of the deductive-nomological (DN) model of explanation, it is clear that laws are only one part of any explanation, with initial or antecedent conditions their vital counterpart. As Earman and Mosterin note, '[a]s far as we are aware, despite all the criticism that has been heaped on Hempel's DN model, no philosopher has criticized it on grounds that it gives prominence to initial conditions' (1999, 20n). The problem, which seems to have led to the acceptance of (or at least the failure to reject) open-systems arguments, is not that initial conditions have not been *criticized* in discussions of explanation, but that they have received so little attention at all.

Extended discussions of laws far outnumber extended discussions of initial conditions or the related concepts of antecedent and boundary conditions. A search in the *Philosopher's Index* (1940-2005) for entries with the term 'laws of nature' in the title finds 124, against only two with the term 'initial conditions', a ratio of over sixty to one. If we add the terms 'laws of physics' on the one hand, and 'antecedent conditions' and 'boundary conditions' on the other, and include both the singular and plural forms, the ratio is still 209:4 for titles and 562:103 for abstracts.[24] Wilson (1991), discussing boundary conditions, summarizes his view of the level of attention to initial conditions vis-à-vis laws: '[T]he standard philosophy text says virtually nothing about boundary conditions – they are scarcely mentioned before they are

[24] Many philosophy articles that do mention initial conditions do so within a modal or 'possible worlds' context, discussing the necessity/contingency of laws (e.g., Schlesinger 1987; Sklar 1991; Beebee 2002; Bird 2002); the direct relevance of these to our discussion of explanation in the actual universe is not clear (although see Frisch 2004 for a possible exception).

packed off in an undifferentiated crate labeled 'initial and boundary conditions' (usually pronounced as one word). The salient fact about 'initialandboundaryconditions' is that, whatever else they may be, they are not laws and can be safely ignored' (Wilson 1991, 565).[25]

How, precisely, do initial conditions account for the spatial irregularities in the universe? Due to recent highly detailed maps of the current universe such as the Sloan Digital Sky Survey (SDSS) and the 2-degree Field Galaxy Redshift Survey (2dFGRS) and their juxtaposition with highly detailed observations of what the primordial universe was like via observations of the Cosmic Microwave Background (CMB) from projects such as the Cosmic Background Explorer (COBE), the Balloon Observations of Millimetric Extragalactic Radiation and Geophysics (BOOMERANG), and the Wilkinson Microwave Anisotropy Probe (WMAP) it has become increasingly possible to empirically test theories of the quantum origins of the universe. This specialized field, sometimes known as 'precision cosmology', sets sharp parameters for plausible theories of cosmology, falsifying many. The current understanding of the initial conditions of the universe, consisting of early spatial inhomogeneities arising from primordial vacuum fluctuations, is beginning to be understood to account for *all* later inhomogeneities, verifying earlier theories of inflation that predict effects from primordial fluctuations in ways set forth by Albrecht (1996; and contra Earman and Mosterin 1999). These increasingly well-supported theories show how primordial quantum fluctuations were vastly magnified through inflation, and then magnified still further through acoustic oscillations (Whittle 2004). This left a spatial imprint in dark matter leading after recombination to the eventual spatial pattern of condensation of early stars and galaxies. Quite simply, we are beginning to understand the development from the true initial conditions of the universe to the current vast and intricate irregularities of the universe.

Just as quantum cosmologists are beginning to understand the development from initial quantum inhomogeneities to current cosmological irregularities, the special sciences have integrated those same irregularities into their understanding and explanation in their areas of interest. As noted above, the irregularities imprinted on

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[25] Even when initial conditions are recognized as important, precisely how and why seldom seems to be pursued by philosophers. For example, in their discussion of inflationary cosmology Earman and Mosterin state that '[t]hese issues about the nature of scientific explanation and the role of initial/boundary conditions are well worth pursuing, but we will not do so here' (1999, 20).

dark matter, and subsequently on matter, allowed for the condensation of galaxies and early stars. These early conditions were the antecedent conditions for later galaxy and second and third generation (our sun) star formation, with the fate of every star (i.e., becoming helium white dwarfs, carbon/oxygen white dwarfs, supergiants etc.) depending on its initial mass. Each generation contributed to the ever greater proportions of higher elements in the universe through stellar nucleosynthesis, giving the higher elements up to iron, with supernovae giving us the still higher elements. These early processes led to the precise antecedent masses, material composition, and velocities (speed and trajectory) of our early solar system and the precise eventual series of collisions and accretion that led to the Earth's distinctive structure. Planetary scientists are beginning to understand how the exact sequence of accretion of the Earth led to critical aspects, such as its large percentage of water (Morbidelli et. al., 2000; Drake and Righter 2002) and how the oblique-angled catastrophic origin of our moon accounts not only for the Earth's unique spin-axis inclinations crucial to our seasons and tides crucial to evolution, but possibly even for the unique plate tectonic activity of the Earth that is responsible for its remarkable diversity compared to other planets (Hoffman 2001a, 2001b). Biologists in turn explain speciation through incorporating the tectonic plate-driven antecedent variation in environments. (Much of this story is the story of ever greater irregularities and hence complexity of interactions. Occasionally, however, there are even still *direct* effects of ancient spacetime trajectories on higher order phenomena, as with the K-T event 65 million years ago and evolution. More speculatively, it is possible that the spacetime trajectory of our solar system still directly affects our weather as the entire solar system passes through nebulous arms of our galaxy, causing or helping to cause ice ages on Earth [Yeghikyan and Fahr 2003, 2004; Gies and Helsel 2005].)

Incredibly, there is beginning to be a unified account in theory and increasingly verified empirically – with many gaps to be sure – between the quantum fluctuations in the early universe to the spatial irregularities of our solar system to the spatial irregularities on our planet, and even to how these irregularities lead to weather systems today (for example, our extremely recent understanding of the El Niño-Southern Oscillation [ENSO] on global weather patterns). This unified understanding is reflected, for example, in the 'Cosmic Evolution' project at the Wright Center at Tufts University ('Wright Center'), telling a unified story from primordial quantum physics through galactic, stellar, and planetary formation to biological speciation; a

similar effort is found in Morowitz 2002 (similar recent works unifying human history and geological times scales include Chaisson 2001, Christian 2004, Mithen 2004, Wood 2004, and Stokes Brown 2007; see also J.R. McNeill 2005 and Schäfer 2006). In effect we have, in theory at least and increasingly supported by empirical evidence, 'explained the wind in St. Stephen's Square'. That is, it is increasingly understood how our highly complex and spatially irregular universe developed despite the existence of laws that are both universal and small in number. Irregular initial conditions have been applied to fields ranging from cosmology and the effects from inflation, star formation, planetary formation, plate tectonics and subsequent formation of the irregularities of the earth, and the role of these variations in biogeographic variation and speciation. Crucially, all of this has been done entirely within the fundamentalist conception of laws, but through the use of initial and antecedent conditions.

2.5 Initial Conditions and 'Systems'

The previous section discussed how initial and antecedent conditions are thought to account for the irregularities in the universe by specialists in increasingly overlapping fields. But what is the relationship between irregularities in the universe and the concept of 'system', especially 'open' systems (and their necessary corollary, 'exogenous factors')? Considering the 'decoherence program' in physics helps us see the problem the concept of 'system' poses for open system arguments and their relationship to initial conditions.

The decoherence program,[26] like the open-systemist argument, is also based on an emphasis on open systems. Furthermore, it too sees the problematic attachment to closed systems in physics as stemming from a 'nomological machines' approach to knowledge in physics: 'The idea that the "openness" of quantum systems might have anything to do with the transition from quantum to classical was ignored for a very long time, probably because in classical physics problems of fundamental importance were always settled in isolated systems' (Zurek 2003, 717). Similarly

[26] The study of quantum-to-classical transitions with an emphasis on their ubiquity in our universe of open systems. Systems can be caused to decohere by outside interference as faint as radiation from the Cosmic Microwave Background (Zurek 1991).

> In classical physics, the environment is usually viewed as a kind of disturbance, or noise, that perturbs the system under consideration in such a way as to negatively influence the study of its "objective" properties. Therefore science has established the idealization of isolated systems, with experimental physics aiming at eliminating any outer sources of disturbance as much as possible in order to discover the "true" underlying nature of the system under study. (Schlosshauer 2004, 1273)

The similarity between the emphasis on the failure of closed systems to provide a useful picture of the universe by open-systemists and in the decoherence program is striking.

Some (e.g., Auletta 2000, 289; Zeh 2005) view decoherence as a possible solution to essential problems of quantum physics, notably the measurement problem. However, there is a fundamental problem with decoherence as something more than a useful approach to comparing existing interpretations of quantum mechanics and perhaps pointing to new interpretations. Crucially, we believe exactly the same problem exists for open system arguments against fundamentalism, yet remains unacknowledged. This problem concerns the concept of systems: 'In particular, one issue which has been often taken for granted is looming big, as a foundation of the whole decoherence program. It is the question of what are the "systems" which play such a crucial role in all the discussions of the emergent classicality' (Zurek 1998, 1818). Similarly, Schlosshauer writes:

> [T]he assumption of a decomposition of the universe into subsystems—as necessary as it appears to be for the emergence of the measurement problem and for the definition of the decoherence program—is definitely nontrivial. By definition, the universe as a whole is a closed system, and therefore there are no "unobserved degrees of freedom" of an external environment which would allow for the application of the theory of decoherence to determine the space of quasiclassical observables of the universe in its entirety. Also, there exists no general criterion for how the total Hilbert space is to be divided into subsystems, while at the same time much of what is called a property of the system will depend on its correlation with other systems. This problem becomes particularly acute if one would like decoherence not only to motivate explanations for the

> subjective perception of classicality…but moreover to allow for the definition of quasiclassical 'macrofacts'. (Schlosshauer 2004, 1274)

Open system anti-fundamentalist arguments face the same problem, viz. What is a (sub)system? Where do they come from? If we cannot answer these questions then both the decoherence program *and* open systems arguments like those of Bhaskar and Cartwright face the fundamental dilemma Zurek and Schlosshauer point out. (We believe the problem raised by Zurek and Schlosshauer strongly applies to Bhaskar/Cartwright type open system arguments. However, the decoherence program itself may surmount the problem. Primordial decoherence is consilient with and probably essential to any future understanding of primordial quantum inhomogeneities and their amplification to subsequent quasiclassical structure in the universe. See Kiefer and Polarski 1998; Kiefer, Polarski, and Starobinsky 1998; Kiefer et. al. 1998; Barvinsky et. al. 1999; Lombardo 2005.)

The term 'system' is well-known for being difficult to define (e.g., Marchal 1975); indeed there is no universally agreed upon definition. A closely related and equally problematic term is 'structure.' For example Shapiro (1997) defines structure *in terms* of systems: structure is 'the abstract form of a system, highlighting the interrelationships among the objects, and ignoring any features of them that do not affect how they relate to other objects in the system' (74); he later remarks that 'What is structure from one perspective is system from another' (94).[27]

Whatever their precise relation, the concepts of (physical) system and structure share the same fundamental problem: The universe as a whole is a system or structure, yet there is no non-arbitrary way to divide the universe into subsystems or smaller structures. Crucially, our divisions seem merely to reflect our anthropocentric perspective, pragmatic goals, and cognitive needs. We see (or create) groups of objects acting in some way and idealize them as a system – a machine, a government, a galaxy, a solar system, a planet, an ecosystem – in order to understand their properties that interest us. But the boundary conditions that define these systems (or structures) are idealized by humans. There may well be steep changes in matter densities, types, or other properties that form apparently natural boundaries and define

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[27] Open-systemists also use the terms interchangeably, e.g., in reference to economics and its 'concepts' (law-like regularities) Cartwright states that: 'nothing follows from the concepts themselves without embedding them in a structure, and only special structures [i.e. 'nomological machines'] will yield any deductive consequences at all' (2002b, 147).

a system (as in a solar system), but these are never complete; idealized bounded systems are in the end open. A paradigmatic example might be the idealization of our sun and its planets as a solar system but our later understanding that this is more open than expected, with the Oort Cloud spawning comets reaching the interior of the system from influences as distant as passing stars and interstellar molecular clouds. Because there never seems to be true closure in the universe, the problem with all subsystems becomes one of boundary conditions regressing to the true initial conditions of the universe. This is a problem even in the most abstract theoretical concept of system/structure, much less in our 'messy' universe of open systems: Carter remarks that 'mathematicians prove things about smaller structures by placing them in larger ones' (2005, 298). (The problem of boundary conditions within boundary conditions leading back to the beginning of the universe is of course well known, e.g., Causey 1969, 232 and Price 2002, section 3.1. Bhaskar notes this possible objection to his argument [1975, 68-69] but does not develop a defense against it).

As we saw in Section 2.4, quantum cosmology has begun to explain how primordial inhomogeneities led to the later inhomogeneities of our universe. We propose that it is these inhomogeneities (and their subsequent interactions) that motivate human idealizations of systems and structures. This is evident in the way these concepts are defined in terms of entities and their spatial relations, that is to say, *spatial irregularities* (i.e. between 'objects' or 'components'). For example, 'system' 'implies an interconnected complex of functionally related components' (Churchman, Ackoff, and Arnoff 1957, 7) and '[a] system is a set of objects together with relationships between the objects and between their attributes' (Hall and Fagen 1956, 18). Even in the most abstract approach to the concept of system and structure, mathematics, these are defined in spatial terms. A system is 'a collection of objects with certain relations' (Carter 2005, 293, summarizing Shapiro 1997) and a structure is 'a collection of places with relations and/or functions defined on those places' (Carter 2005, 305, summarizing Resnik 1997). Indeed, if we could somehow imagine a *perfectly* homogenous universe it would seem impossible to imagine how systems/structures might exist. There would be no components or objects to interact with one another. Crucially, it is the development from primordial irregularities of the later irregularities in the universe that gives us 'objects' and 'components' that can interact and which humans idealize as systems or structures. Open system anti-

fundamentalist arguments are silent on this issue. The fundamentalist approach (with initial conditions), however, is both theoretically and increasingly empirically successful in accounting for the irregularities that form the basis for human conceptions of system/structure.

2.6 Why Initial Conditions Are So Often Ignored.

If initial conditions are so important, why are they so frequently ignored, as discussed in Section 2.3? One possibility is that the focus by philosophers on the heroic period of law seeking from the Enlightenment to the twentieth century has served to obscure the importance of initial conditions to the philosophy of science. There are likely at least two more reasons, (i) anthropocentric views of time and (ii) quantum uncertainty.

An anthropocentric view of time seems to make humans loath to the idea that ancient initial conditions control outcomes on cosmological time scales. For example, in a frequently cited passage (e.g., Clarke 1999, 9-10; Waldner 2002, 21) from *The Chances of Explanation*, Humphreys asks us to

> Consider a man who, on a whim, takes an afternoon's motorcycle ride. Descending a hill, a fly strikes him in the eye, causing him to lose control. He skids on a patch of loose gravel, is thrown from the machine, and is killed. This sad event, according to the universal determinist, was millions of years beforehand destined to occur at the exact time and place that it did…This claim, when considered in an open-minded way, is incredible. (Humphreys 1989, 17)

However, we should not limit the philosophy of science to suit human cognitive predispositions adapted to understanding short time scales and small spatial scales, anymore than we reject the findings of quantum physics based on its different spatial and temporal scales. If we are to believe that some 'uncaused cause' has intervened between the initial conditions of the universe and later outcomes, it must be shown how, when, and where this has occurred. So far this has not been done.

As noted in the Introduction of the dissertation and evident in Humphrey's view above, indeterminism would diminish the importance of initial conditions. And indeed the open-systemist neglect of initial conditions and its attack on 'fundamentalism' is

part of a broader anti-deterministic (or pro-probabilistic) consensus that stems in part from the advent of quantum physics. Cartwright introduces *The Dappled World* by declaring that '[f]or all we know, most of what occurs in nature occurs by hap' (1999, 1) while Bhaskar pronounces regularity determinism 'a mistake, which has been disastrous for our understanding of science' (1975, 69).

Despite common conceptions, however, it is not at all clear that quantum physics has overturned determinism. It is not sufficiently appreciated in the social sciences that even the *standard* interpretation (i.e., *not* just heterodox interpretations such as the Bohm interpretation) of quantum mechanics by no means incontrovertibly shows that the universe is fundamentally indeterministic.[28] In a careful recent survey of the topic asking the question 'If we believe modern physics, is the world deterministic or not?' John Earman concludes that 'there is no simple and clean answer' (Earman 2004, 43). The very difficulties encountered by the probabilistic consensus in providing a coherent model of explanation suggests something fundamentally wrong with the probabilistic assumption; literally *all* attempts to form logically consistent accounts of macro- (i.e., ontologically emergentist) and probabilistic causation fail. Macro- and probabilistic- causation remain an inelegant 'folk science' (there are *no* theoretically consistent and intuitively satisfying accounts of probabilistic [and non-reductionist] causality, Norton 2003), while a conserved quantity, non-probabilistic (i.e. deterministic), reductionist (i.e. non ontological-emergentist) view of causality remains entirely intuitively and theoretically coherent (Burock 2004). Rather than continuing on what has proven to be a barren intellectual path in reaching a consistent understanding of explanation, perhaps it is time to pay more attention to initial conditions and how, together with laws, they can and are explaining the (weak, non-ontological) emergence of and interactions between the many phenomena in the universe that interest humans. As Halonen and Hintikka state, 'finding the right "initial conditions" is in practice usually the most important part in the process of explanation' (2005, 48). Indeed, for explaining much of what interests philosophers, scientists, and laypersons alike about the universe and our world initial conditions are

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[28] The relationship of the absence of closed systems within the universe to the lack of observed quantum indeterminism is widely accepted among physicists, e.g., 'The theory of quantum mechanics applies to closed systems. In such ideal situations, a single atom can, for example, exist simultaneously in a superposition of two different spatial locations. In contrast, real systems always interact with their environment, with the consequence that macroscopic quantum superpositions (as illustrated by the 'Schrödinger's cat' thought-experiment) are not observed' (Myatt *et. al*. 2000, 269).

in a sense significantly *more* important than laws, because while laws constrain, it is initial conditions that account for the initial variation and subsequent rich complexity in the universe.

2.7 Conclusion

Cartwright has written that once we 'climb up' to the most fundamental laws of nature, there is no way 'within a pure regularity account to climb back down again' (1999, 95, a point she reemphasizes in 2002a, 438, note 15). Yet this is precisely what antecedent conditions, traced ultimately back to true initial conditions, allow us to do. They provide the rough surface, as it were, on which to apply our climbing toolkit of laws, allowing the descent to the concrete, contingent, context-specific situations that scientists and social scientists often want to explain. Furthermore, the irregularities that can be traced to initial conditions account for the anthropocentric perception of 'systems' and their 'exogenous' factors. Open systems arguments, however, are tellingly silent on the ontology and origins of 'systems' – the very basis of their argument.

The open system rejection of laws of nature brings to mind a problem recently pointed out with an idealized Newtonian universe. McAllister (1999 and 2004) shows that a Newtonian universe is inconsistent. The traditional conception of a Newtonian universe is that it is governed by laws and initial conditions, and consistent with the D-N model of explanation (McAllister 1999, 327-328). If one wanted to explain, say, the motion of a body in a solar system within a Newtonian universe one would consider the laws of motion in that universe, along with the initial velocities (speed and trajectory) and masses of the bodies in the solar system. However, the inconsistency that McAllister points out is that there is no way to introduce initial conditions into a Newtonian universe. These would be, in effect, a set of impermissible exogenous factors in what is by definition an isolated system. Thus one must posit further laws that explain the solar system in question; this regresses infinitely, so there can never be any initial conditions in a Newtonian universe. Ergo, it must have no initial conditions, and be defined only by laws.

However, as McAllister notes, he is only pointing out an inconsistency in the concept of an *idealized* Newtonian universe (2004, 203); this critique does not apply to the actual universe because it seems to have a beginning, the Big Bang. In our

universe there are initial conditions as well as regularities (that may be universal laws of nature), thus our real world does not fall into the paradox he points out for a Newtonian universe. Cartwright's claim that '[t]he only way a condition could restrict the range of an association in a principled or nomological way would be via a more complex law' (Cartwright 1999, 138) is like McAllister's observation of the inconsistency of a Newtonian universe that can only have laws. But just as it is immediately apparent that this inconsistency most likely does not apply to the actual universe because it has initial conditions, so too it is apparent how easily open system objections are resolved by initial conditions. The critical question is not whether the open-systems view is more compelling than a scientific attempt to account for the complexity of our universe through laws 'all the way down', but whether it is more compelling than a scientific attempt to explain the complexities of our universe with laws *and* initial conditions.[29]

Overall, humans seem to have a deep desire to see causal relations between the emergent irregularities ('systems', 'structures', 'objects', 'components') of the universe, and thus we look for non-existent constant conjunctions between these. We agree with open-systemists such as Bhaskar and Cartwright that these do not exist, and that this is a highly significant fact. But the empirically supported interpretation of this fact is that the macro relations that we do see are spatiotemporal *trends*, trends that ultimately stem from irregular micro initial conditions in a universe with universal laws.

Interestingly, the primordial onset of ubiquitous decoherence suggests that the significance of quantum indeterminacy to explanation in our quasiclassical universe may need to be reconsidered. Quantum indeterminacy may yet be understood to define much of what our classical universe is like. But not through undermining universal laws and introducing ontological chance directly into the post-inflationary universe, but rather through primordial vacuum fluctuations providing the universe with irregular initial conditions, and thus transmitting the contingency of quantum phenomena throughout the universe by way of the spacetime trajectories of matter.

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[29] This of course begs the question of whether we can explain the beginning of the universe, as in chaotic inflation, multiverse and anthropic principle scenarios (Tegmark 2004 provides a useful classification of the possibilities). This is beyond the scope of our discussion. However, it is possible that laws, constants, and initial conditions of the universe may simply have to be accepted as 'brute facts' (see Callender 2004).

CHAPTER 3
CLASSIFYING CONTINGENCY: DIACHRONIC, SYNCHRONIC, AND DETERMINISTIC CONTINGENCY

The previous chapter considered the important role of initial conditions in the philosophy of science. Initial conditions play the crucial role in explaining the spatial distributions and spacetime trajectories of matter in the universe. This explanation of spatial distributions and irregularities has important ontological implications, accounting for what humans perceive of as 'systems' and obviating the need for 'natures' or 'capacities' in explanations of outcomes. The spacetime trajectories of matter in the universe are potentially important to explaining contingent outcomes if these are seen as resulting from the interference to a system by context-specific exogenous factors. The purpose of this chapter is clarify the concept of contingency because it is so frequently relied upon in explanations of uneven development yet such a poorly defined concept.

3.1 Introduction

The concept of 'contingency' is widely invoked in the social sciences, sometimes even claimed to be central to an understanding of the social and historical sciences. Sociologist Wagner-Pacifici, for example, asks: 'Might not one say that the whole project of sociology is to account theoretically for the contingent patterns and shapes of this mutable and mutating social stuff of life…?' (Wagner-Pacifici 2000, 1). In economic geography, Plummer states that 'In order to make any headway in empirical modelling…we need to formulate theories in which the nature of contingency and complexity…are specified more clearly' (Plummer 2001, 764). For the historical sciences more generally Stephen Jay Gould states that 'the science of contingency must ultimately be integrated with the more conventional science of general theory' (Gould 2002, 46).

These views on contingency in the study of society, a concept already given importance by historians such as J.B. Bury and W.B. Gallie, seem to have been on the

rise in recent decades. For example, contingency was central to the renewed focus on 'the local' by geographers in the 1980s. Concerning the study of the location of industrial clusters, economic geographers A.J. Scott an D.P. Angel write that '[t]he seeds of many of these growth sectors seem to have been planted at particular locations in what amounts to a set of highly contingent circumstances' (Scott and Angel 1987, 878). Describing the legacy of the work associated with Doreen Massey Scott writes 'On the one hand, localities were seen as being subject to wider national and international capitalist forces; on the other hand, these forces were also seen as being channeled through complex local contingencies' (Scott 2000, 491). Pred writes of 'Place as Historically Contingent Process' (the title of his 1984) while in their defense of regional geography, Johnston, Hauer and Hoekveld (1990, 1-8) use the word contingency seven times in eight pages; the word appears 29 times in the short section discussing the meeting of the abstract and general with the real and local, 'The Difference that Space Makes', in Duncan and Goodwin (1988, 46-61).

This association of contingency with local variation in development has continued through the 1990s to the present in the work of economic historians, historical sociologists, and economists. Historical sociologist Jack Goldstone, writing on the industrial revolution, argues that there is a growing consensus that the movement towards a modern industrial economy in Great Britain was 'chiefly the result of a contingent and conjunctural pattern of events' (Goldstone 2002, 332). Abu Lughod (1989) argues there were similar historical conditions in Europe and China, and a critic observes: 'how then does Abu Lughod explain these areas' subsequent divergence? Contingency and circumstance' (Lieberman 1993, 548). Comparing industrialization in China and Europe historian R. Bin Wong argues for 'a set of contingent rather than causal connections between commercial development and industrial breakthroughs (Wong 1997, 279)[30] and P. H. H. Vries states 'I think there is

[30] Wong elaborates that 'only the initially contingent fit between the institutions of capitalism and the technologies of industrialization made possible the pattern of economic change that unfolded in nineteenth century Europe, a pattern that broke free of the world of limited material growth analyzed by the classical economists. If we accept these contingencies, we can also accept more easily the prior presence of similar dynamics of economic expansion which on their own could not drive either the Chinese or European economies into a world of vastly greater material wealth. This argument about economic change suggests that the presence in China of some dynamics of expansion similar to those in Europe makes likely a set of contingent rather than causal connections between commercial development and industrial breakthroughs' (Wong 1997, 279).

an element of historical contingency—or better geographical contingency—that really mattered' (Vries 2001, 439).

The concept of contingency is frequently encountered in other areas of the social sciences as well. The concept is central to the counterfactual political science of Tetlock and Belkin (1996) and Lebow (2000a, 2000b) and the counterfactual history of Ferguson (1997). The concept of contingency has perhaps been still more important in recent decades in biology, associated with Gould's emphasis on the contingency of evolution. In turn, the emphasis on contingency in biology has had a substantial impact on all of the historical sciences, including the social sciences (e.g., Blaser 1999; there are countless references to Gould's emphasis on contingency in the social sciences). However, despite the frequency of reliance on the concept of contingency to characterize the phenomenon of local variations in development patterns, this concept seems to be poorly defined.

In this chapter we make three claims concerning the concept of contingency, especially as related to the study of society. First, we argue that the word contingency is used in far too many ways to be useful; its many meanings are actually detrimental to clarity of discussion and thought in history and the social sciences. We show how there are eight distinct uses of the word supported by numerous examples from the social sciences and history. This alone we hope is useful, bringing to light the extent of the many, often contradictory uses of the term in the social and historical sciences.

Second, we try to impose some order on these eight different uses. We develop a classification of contingency into three classes based on assumptions about possible worlds and determinism, and show the relationship of the eight common uses of the term to these three classes. Finally, we discuss why we believe that one of the classes is a special use of the word without relevance to the social sciences, while the two remaining classes are nothing more than a variety of the 'no hidden factors' argument in the debate on indeterminism and determinism, related to the concept of spacetime trajectories caused by initial conditions and the interference of these (in the form of 'exogenous factors') with 'open systems'.

3.2 The Many Meanings of Contingency

In this section we illustrate eight common uses or connotations of the word 'contingency' with examples drawn primarily from the social sciences (including history).

1) ***Modal Logic*** In philosophy, a standard definition of 'contingent' is 'neither necessary nor impossible'. This definition is sometimes explicitly used in the social sciences:

> Contingency involves the 'exclusion of necessity and impossibility' (Luhmann 1987, 152 in Schedler 2004, 7).

> 'Contingent means "neither necessary nor impossible"' (Sayer 2000, 123).[31]

As we will discuss in greater detail in Section 3.3 a special type of modal logic usage occurs in ***possible worlds semantics***. We sometimes find this specific usage in the social sciences:

> 'individuals or other phenomena have both necessary qualities, existing across all possible worlds, and contingent qualities, existing in only some possible worlds' (Sylvan and Majeski 1998, 82).

2) ***Popular Usage*** In popular usage 'contingent' often means 'depends on' as in 'x is contingent upon y'. This popular use is also common in the social sciences:

> 'Globalization's effects on democratization are thus indirect, contingent upon the scope and desirability of redistributive policies'. (Rudra 2005, 708)

3) ***Chance***

> Contingency in history is '[t]he view that chance and accident play as important a role as structure' (Brucker 2001, 1).

> 'In the literature, there is a pronounced tendency to conflate the concepts of chance and contingency' (Ben-Menahem 1997, 103).

---

[31] We maintain the use of quotation marks in the block quotes in this section to assure that there is no confusion between quotes and discussion.

'Contingency carries the mark of chance, uncertainty, unpredictability' (Schedler 2004, 5)

'dominant themes [of contingency are] chance, uniqueness, unpredictability, and crucial episodes of unexpected change' (Gould in Bintliff 1999, xii).

4) Free Will/Agency Contingency is often viewed as related to or the result of free will/agency:

'Oakeshott argues that agents are "free" by virtue of their ability to choose particular contingent responses to their situations'. (Mapel 1990, 393)

'Aspiring to create space for contingency and free human action, Berlin criticises the notion of historical necessity.' (Ben-Menahem 1997, 103).

'Economic processes are … contingent in that agents' strategies and actions may deviate from existing development paths' and 'context is related to structure and contingency associated with agency' (Bathelt and Glückler 2003, 128 and 128n).

5) *Path dependency*

'[P]ath dependence characterizes specifically those historical sequences in which contingent events set into motion institutional patterns or event chains that have deterministic properties' (Mahoney 2000, 507). 'In a path-dependent pattern, selection processes during a critical juncture period are marked by contingency'. (Mahoney 2000, 513).

'QWERTY is a classic example of the power of history, and the meaning of contingency.' (Blaser 1999, 420)[32]

6) *Chaos*

'Chaos and contingent-necessity model phenomena in the same manner' (Shermer 1995, 72).

---

[32] The QWERTY keyboard is, of course, virtually synonymous with path dependency following Paul David's (1985) now classic 'Clio and the Economics of QWERTY'.

'The philosophical significance of chaos theory is that it reconciles the notions of causation and contingency' (Ferguson 1997, 79).

'[C]haos theory reconciles causation with contingency by linking causally unpredictable outcomes to initial conditions' (Tucker 1999, 269).

Often found alongside the association of contingency with path dependency or chaos are assertions that contingency means momentous, sudden, or high degrees of change[33] stemming from a small event. (The first example is from Pierson's article on path dependency and political science, the second from Lindenfeld's article on chaos theory and history):

'*Contingency.* Relatively small events, if they occur at the right moment, can have large and enduring consequences.' (Pierson 2000, 263)

'the butterfly effect does indeed appear to vindicate what we have known all along, that seemingly trivial events can have momentous consequences. This goes under the name of the role of contingency in human affairs' (Lindenfeld 1999, 287)

7) *Conjuncture*

'[Historical contingencies are] distinctive conjunctures of events or other singularities that theory cannot comprehend.' (Goldthorpe 1997, 22)

'In this analysis "contingency" will be taken to mean *a conjuncture of events without perceptible design*' (Shermer 1995, 70).

Contingencies in the form of random events and conjunctures of multiple chains of causation are difficult to deal with theoretically (Lebow 2000b, 612).

Little's (2000) 'Conjunctural Contingent Meso History'.

A variety of the concept of 'conjuncture' is *context.* This usage is found when there is a conjuncture of multiple factors, usually in a spatiotemporal context. Their

[33] This view is evident in the association of contingency with disasters and cataclysms (e.g., Krieger 1968, 'Culture, Cataclysm, and Contingency') and thus the popular usage 'contingency planning' and 'to prepare for any contingency'.

concatenation in one place (also ‘locale’, ‘milieu’ etc.) is frequently described as contingent:

> ‘sometimes contingency is used to mean context’ (Blute 1997, 347). Blute is referring to Mann (1994):
>
> ‘Many causal paths cross, and the combination of factors in each spatiotemporal location makes it unique – this is where contingency is the same as “context”’ (Mann 1994, 47).
>
> ‘Place as Historically Contingent Process: Structuration and the Time Geography of Becoming Places’ (the title of Pred 1984).
>
> ‘locality events are understandable, in the language of realism, as contingent’ (Lovering 1989, 213).
>
> “‘space’ or ‘the spatial’ is…an appealing commonsense shorthand way of signifying…‘the contingent effect of the uneven development of social process’” (Duncan and Goodwin 1988, 228-229).
>
> ‘the contingency and complexity of place’ (Plummer 2001, 761).

8) Unpredictability Finally, many of the above definitions - chance, free will, chaos - lead to *unpredictability*, and this is frequently associated with the concept of contingency:

> ‘Gallie’s use of “contingent” seems to be equal roughly to “unpredictable from the point of view of the main process”’ (Arthur 1968, 208).
>
> ‘As Gould notes, contingency is an unpredictable sequence of antecedent states’ (Shermer 1999, 218).
>
> ‘Contingency refers to the inability of theory to predict or explain, either deterministically or probabilistically, the occurrence of a specific outcome’ (Mahoney 2000, 513).

In the preceding quotes we have shown that there are numerous uses of the word ‘contingency’ in the social sciences, many closely related to other confusing or

incompletely understood concepts such as chaos, chance, and path dependency. Adding to the confusion created by these different uses, they are frequently conflated in a single work:

> 'Path dependence is the application to economic systems of an intellectual movement that has lately come into fashion in several academic disciplines. In physics and mathematics, the related idea is called chaos - sensitive dependence on initial conditions…In biology, the related idea is called contingency' (Liebowitz and Margolis 1995, 33).

Even when not explicitly conflated as in the example above, chaos, path dependency, chance, free will and the other confusing concepts we find associated with contingency are so frequently found in such poorly defined association with one another as to *encourage* their conflation, e.g.:

> 'the pragmatist sensitivity to indeterminacy, contingency, and chaos.' (Shalin 1992, 238).

> 'the event structure displays the crucial role played by human agency, contingency, and path dependency' (Griffin 1993, 1117).

Not only are these concepts often conflated and ill-defined; frequently they are contradictory. For example, above were several examples that associate 'context' with contingency, yet Bathelt and Glückler emphasize that 'context is related to structure and contingency associated with agency' (2003, 128n). We find assertions that contingency signifies momentous changes from small effects (e.g., both Lindenfeld and Gould above) but we find Sayer warning that '[c]ontingency is also not to be confused with importance!' (2000, 124). There are countless examples where contingency is associated with chance, yet Shermer stresses that 'contingency…is not randomness, chanciness, or accident.' (1999, 218). Sayer provides a modal logic definition of contingency, yet says that it is 'virtually opposed' to the use of the word to mean 'x is contingent upon y' (Sayer 2000, 28). The term frequently serves to elide clarity on all of these issues rather than commit the author to a clear position on any of them.

Section 3.3 below introduces a classification of contingency into three types based on assumptions of possible worlds and determinism. In Section 3.4 we then consider the relationship of the eight uses of contingency above to these three classes.

3.3 Three Classes of Contingency: Diachronic, Synchronic, and Deterministic

Above we have shown how there are an extraordinary number of uses of the word 'contingency' variously used to mean, or in close association with, concepts such as conjuncture, context, chaos, chance, and path dependency. We now propose that the concept of 'contingency' can be divided into three classes based on assumptions about possible worlds and determinism. We introduce the classes here and then consider how the above uses relate to these classes in Section 3.4.

3.3.1 Diachronic contingency

In ancient philosophy the concept of 'possibility' referred only to possibilities in the *actual* world (Knuuttila 1993, 2003). Consider Figure 3.1 below:

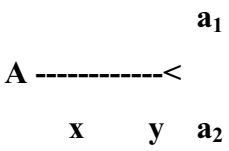

Figure 3-1 Diachronic Contingency

Line 'A' (with time moving from left to right) represents one world, the actual world. At point *x* we might consider the possibility of some outcome, say, Sally finding a treasure chest. In outcome a_1 Sally finds the treasure chest, whereas in a_2 she does not. Note that this implies that at *y* something happens that allows for either one outcome or another – for Sally to find the treasure chest (possibility a_1), she is either lucky, or chooses a particular area to search, implying that at *y* respectively either chance or free will caused outcome a_1 rather than the possible outcome a_2 (divine intervention being another possibility).

3.3.2 Synchronic contingency

The above view of possibilities in the actual world is a *diachronic* view of possible worlds, with a single world with branches representing future possibilities. The concept of possibility as referring to *other* possible worlds was not developed until much later.[34] Having *multiple* possible worlds allows for *simultaneous* alternatives and so is a *synchronic* view of possible worlds. In the synchronic conception of possibility, rather than think of outcomes a_1 and a_2 as different possibilities for the actual world A, we would think of them as different possible worlds. Thus we have a world A where Sally finds a treasure chest, and a completely unrelated world B where she does not.[35] Following Figure 3.1, this idea could be represented as in Figure 3.2 below:

A ----------

B ----------

Figure 3-2 Synchronic Contingency

Note that in the synchronic view of possibility, for Sally to find treasure or not to find treasure there is no need to appeal to something such as free will or chance (as at point *y* in Figure 3.1) to explain different outcomes in world A and world B. Because they are completely unrelated (causally, spatially, and temporally unrelated) there can be infinite worlds where treasure is found, is not found, and where an infinite number of other possibilities exist completely independent of each other.

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[34] See, for example, Knuuttila 1993, 2003, Øhrstrøm, and Hasle 1995, and Wyatt 2000. We purposefully simplify here, ignoring such ancient modal concepts as 'potency' and 'statistical' interpretations of possible worlds as well as modern debates between 'real', 'fictionalist', 'ersatz' etc. possible worlds (for these modern difficult and highly debated concepts see, for example, Stalnaker 1976, McMichael 1983, Rosen 1990, Roy 1993, Shapiro 1993, Baldwin 1998, Divers 2006).

[35] Again in the interest of simplicity we ignore debates on esoteric ideas such as indexicals and hacceity.

2.3.3 Deterministic contingency

A ----------

Figure 3-3 Deterministic Contingency

Finally, consider Figure 3.3 above. Here we have a single line representing just one world, the actual world. It is non-branching, depicting a deterministic world where there are no alternate possibilities. It might at first seem that the concept of contingency could not mean anything in this world because there are no alternate possibilities. However, as we saw in Section 3.2, one use of the word contingency is to describe the result of a conjuncture. This is frequently expressed as the coming together of 'separate causal paths'. These causal paths could, at least in theory, be traced unbroken; there is no claim made for a break in the historical causal chains of the factors in the conjunction as there is when acausal chance or free will are called upon to account for a 'contingent' outcome.[36] A recent statement of this idea from biology expresses this view of contingency and deterministic causal chains well:

> Contingency may be defined as the outcome of a particular set of concomitant effects that apply in a particular space-time situation and thus determines the outcome of a given event. In most of the epistemological literature, this word has aptly taken the place of the term `chance' or `random event', and in fact, it has a different texture. For example, a car accident can be seen as a chance event, but indeed it is due to the concomitance of many independent factors, like the car speed, the road conditions, the state of the tyres, the alcohol consumption of the driver, etc. These factors all sum together to give the final result, seen as a chance event. The same can be said for a stock-market crash, or the stormy weather of a particular summer day. Interestingly, each of these independent factors can actually be seen per se as a deterministic event, e.g. the bad state of the car tyres determines per se a car sliding off at a curve. The fact, however, that there are so

[36] Thus this type of contingency could take place under 'causal determinism', now usually equated, in our view correctly, with common Laplacian concepts of determinism (e.g., Hoefer 2003, para. 2). We call this category 'deterministic' as an ideal type distinguishable from *fundamentally* indeterministic diachronic contingency. Whether one believes these various ideal types co-exist is a separate issue.

> many of these factors, and each with an unknown statistical weight, renders the complete accident unpredictable: a [non-ontological] chance event. (Luisi 2003, 1142)

What frequently causes mere conjuncture to be labeled 'contingency' is the point of view of the agent. For example, one of Lamprecht's examples of contingency in 'Contingency in Nature' (1971) is a hunter with excellent aim who fires at a buck. To the hunter's surprise the buck gallops off unharmed. Puzzled, the hunter follows the path of the bullet towards the prey, and finds a freshly broken branch in the path of the bullet. Apparently a breeze had blown the branch just as the hunter fired, deflecting the path of the bullet. This 'contingent' event caused the hunter's bullet to miss the buck. In this example, at least in theory if not in practice, the causal chain of the wind and growth of the tree branch could be traced (unlike in diachronic contingency where free will or ontological chance are acausal, representing a fundamental break with any causal history). But *to the hunter* who at the time of the event had no knowledge of the impending gust of wind or the existence of a wind-sensitive tree branch, the outcome seems contingent. This would not be so if the hunter had had full knowledge of the existence and impending confluence of these factors. In biology the extinction of the dinosaurs is frequently held up as prime example of a contingent outcome due to the K-T event 65 million years ago. Again, there is not necessarily ontological chance involved. From a terrestrial view the event is contingent; to aliens viewing the development of Earth but also with full knowledge of the trajectories of asteroids it would not be viewed as contingent.[37]

The view of contingency as ignorance of other causal streams or 'systems' of the universe, and hence ignorance of how they will eventually impinge upon each other, is common in the social sciences. For example, it is the view of one of the more influential social science discussions of contingency, J.B. Bury's 'Cleopatra's Nose'. The view that contingency refers to an individual's degree of knowledge about separate systems or causal streams is clear in his discussion of 'pure' and 'mixed' contingencies. Pure contingency results from seemingly completely unrelated systems

[37] The similarity of this statement to the idea of a Laplacian demon is readily apparent, foreshadowing our later argument that views on contingency and views on hidden factors and determinism are varieties of the same problem.

interfering with one another; as we begin to deem the systems as more and more related, we think of the event as less and less contingent:

> If Napoleon at an early stage in his career had been killed by a meteorite, that would have been the purest of pure contingencies…The meteorite was completely disinterested in his death…But suppose Napoleon would had been killed by the hand of an assassin who detested his policy. This would not be a pure contingency. For the assassin was interested in Napoleon's death, and the causal sequence which led him to commit the act would have been connected with the causal sequence which rendered the great man's death historically important. (Bury 1916, 67-68).

In Bury's example, the more separate the causal paths that come together the more contingent an agent will view the outcome. Bury, like Luisi, emphasizes that the 'chance' of contingency results from the collision 'of two or more independent chains of causes' (Bury 1916, 61). There are numerous allusions to contingency as resulting from the conjuncture of multiple factors or systems in the social sciences, often stressing the *ignorance* of other systems (and thus ignorance of their impending interference with one another). In addition to the examples in Section 3.2, Mandel characterizes 'contingent…historical accidents' as 'occurrences that represent an unpredictable or fortuitous *confluence of factors*' (2003, 178, emphasis added) and Steinmetz writes that 'contingency here means that complex events are codetermined by constellations of causal mechanisms' (Steinmetz 1998, 177). Jessop discusses contingency as meaning 'indeterminable within the terms of a single theoretical system' (Jessop 1990, 12) and Arthur writes that 'Gallie's use of "contingent" seems to be equal roughly to "unpredictable from the point of view of the main process"' (Arthur 1968, 208). These views of contingency are similar to those of Bury, Luisi, and Lamprecht above, as the (necessarily unexpected) influence of an outside system (or 'exogenous factor') on the system the agent is a part of or is considering.

3.4 Sorting the Uses of Contingency into the Three Classes

Above we have listed three ways to think about contingency – *diachronic contingency* (an indeterministic actual world, with contingency arising from

ontologically indeterministic events such as freely willed action or ontological chance), *synchronic contingency* (simultaneous infinite possible worlds where non-necessary but possible things can exist in other worlds with no recourse to indeterminism necessary), and *deterministic contingency* (where a mere lack of *knowledge* of other systems and their impending interference as 'conjunctures' or 'exogenous factors' cause outcomes to appear contingent to an agent). We now briefly consider the relationship of the eight common uses of contingency from Section 3.2 with these three classes. We will then discuss the classes in greater detail in Section 3.5.

Four of the uses from Section 3.2 have obvious and straightforward relationships with the classes of contingency introduced in Section 3.3. Although the concepts themselves—especially possible worlds semantics, chance, and free will—are highly contested their *position* among the three classes of contingency is straightforward. The possible worlds semantics use clearly fits into the synchronic class of contingency (constituting the whole class). Similarly 'chance' and 'free will' easily fit into the diachronic class of contingency (as discussed above, for there to be alternate possible futures in the *actual* world something—ontological chance, free will, or divine intervention—must occur at point *y* in Figure 3.1). Finally, the relationship of conjuncture/context with the deterministic concept of contingency is relatively straightforward.

We believe the remaining four uses of the term 'contingency' are, on closer examination, near-synonyms of contingency whose conflation with contingency nevertheless causes a great deal of confusion. Before moving on to discuss in greater detail the synchronic, diachronic, and deterministic classes of contingency we briefly consider why it is best to distinguish unpredictability, 'depends on', chaos and path dependency from the concept of contingency.

Unpredictability is a general result or attribute of contingency, rather than a definition of the word itself. It applies to most conceptions of contingency and itself does not belong to any one class, while conversely, unpredictability can also arise from many other sources besides (some form of) contingency. Using the term 'contingency' merely to express unpredictability permits far too many other connotations to be conveyed and if expressing precise ideas is the goal then would best be avoided. Similarly, using the phrase 'contingent upon' in lieu of 'depends on' is common in academic writing, but it risks reducing contingency simply to

covariation. If everything that 'depends on' something else is a form of contingency, then contingency is nothing more than a particularly obscure way to make a causal assertion.[38] With both of these uses we think it would be better, in the interest of clarity, to avoid the term 'contingency' altogether unless one wants to signify something more than simple unpredictability or 'depends on' and is both willing to make clear precisely what additional meaning is intended (and, more onerously, what is *not* meant) and what metaphysical commitments one is willing to defend in its use.

This leaves two more examples from Section 3.2 - chaos and path dependency - that should not, for what we believe are similar reasons, be conflated with contingency. Chaos - unpredictable outcomes in deterministic systems resulting from small changes in the initial conditions of the system (Reitsma 2003, 14) - is conflated with or closely linked with contingency primarily through the concept of unpredictability. However, we do not believe deterministic chaotic systems should be regarded as giving *contingent* outcomes, but merely outcomes that are unpredictable. This may seem counterintuitive at first. Because chaotic systems are deterministic, it is clear they are not a type of diachronic contingency, which is fundamentally indeterministic. Nor is there any relationship between chaos and synchronic contingency. It might seem, though, that chaos *is* a form of deterministic contingency, as neither relies on indeterminism for their unpredictability. However, the unpredictability of chaotic systems arises because of the *inherent* nature of chaotic systems which are always *closed*. For some reason these systems respond in surprising ways to small differences in initial conditions, and this is why they are interesting. In contrast, the unpredictability of deterministic contingency arises precisely because of (unexpected) *outside* interferences with the system under consideration. The unpredictability of deterministic contingency is not caused by anything inherent in the system under observation, but precisely the opposite. Conflating chaos and deterministic contingency diminishes what is distinct and interesting about both concepts.

Finally, path dependency is linked to contingency primarily through the concept of multiple equilibria, which is the same as saying there are multiple possible

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[38] As Schedler observes: 'To say something is contingent then is to say: It depends. It is to say: The empirical phenomenon *y* is variable / indeterminate / contingent because *it depends* on variable / indeterminate / contingent causal factors *x*. Contingency equals covariation. Intriguingly, in the methodological mainstream of contemporary social science, this simple notion of covariation provides the (orthodox and thus non-contingent) foundation of causal explanation.' (Schedler 2004, 14).

contingent outcomes. A common way of depicting path dependency is as a Polya urn process. Imagine a large urn with a red, a blue and a yellow ball in it. A ball is taken out, then that ball is returned to the urn with an additional ball of that same color. In the first turn, the probability that a ball of any color taken out is equal. However, if a red ball is taken out and then returned with an additional red ball, on the next turn there is a higher chance of a red ball being taken out. If, as is increasingly likely, the next several turns extract a red ball, soon there is virtually no chance of drawing blue or yellow balls. The first few draws from the urn result in a 'lock in' effect for either red, blue, or yellow balls. Thus the replacement rule simulates the concept of increasing returns leading to 'lock in', with early events leading to lasting later pathways.

However, as with chaos, it is important not to conflate path dependency with contingency. Think of the Polya urn process again – what is interesting about it is the lock-in effect, which is caused by the replacement rule in the Polya urn example. The question, then, is why *that* replacement rule? Why are we returning two (or three or a hundred) balls for every ball withdrawn? (Just as in economic systems, we want to know *why* there are increasing returns). As with chaos, so too with path dependency - conflating path dependency with contingency obscures what is distinct about both concepts.[39]

3.5 Discussion and Conclusion: The Three Classes of Contingency - Which is 'Best'?

To review, three of the concepts commonly associated with contingency - chaos, path dependency, and to mean 'depends on' - are conceptually closely related yet subtly distinct near-synonyms whose conflation with contingency can only cause confusion. A fourth concept – unpredictability - is more of a description that fits many things (and happens to include contingency). In the interest of clarity it would be better to avoid conflating the word 'contingency' with these four concepts; the original terms are more precise and diminish the likelihood of so many unintended meanings creeping into an argument. Eliminating these four uses leaves four other

[39] Essletzbichler and Rigby similarly conclude that 'Path-dependence is itself an outcome of various causal mechanisms and on its own lacks explanatory power' (2007, 559).

uses that *do* fit into the three classes of contingency - possible worlds semantics in the synchronic class, contingency resulting from chance or free will in the diachronic class, and conjuncture/context in the deterministic class.

Ideally, simply illustrating the degree of diversity of uses and hence endless opportunities for confusion will discourage all but the most careful and considered use of the word 'contingency'. We introduced the classification system, however, to draw out important implications and make clear the various metaphysical commitments of the different uses of the term. Beyond these efforts we cannot, of course, decree one class to be definitively correct. However, there are reasons to suspect that one of these classes should not be used in the social sciences. The remaining two classes can then more easily be seen as simply a variety of the familiar debate on determinism/indeterminism, specifically the 'no hidden factors' debate.

The class of contingency we think is irrelevant to the social sciences is the synchronic class. In recent decades when the concept of contingency is raised it has been common to find references to possible worlds semantics and definitions of contingency that appear to be synchronic.[40] This is not surprising given two facts. First, social scientists frequently look to philosophy for clarification of confusing terms, and second, in recent decades within philosophy possible worlds semantics have been 'decidedly in philosophical vogue' (Rescher 1999, 403). Usually, turning to philosophy for definitions is to be commended given the rigor with which philosophers define their terms. However, in this particular case it has led to confusion. The possible worlds semantics definition social scientists have come away with from philosophy due to its high visibility in recent decades is not representative of the meaning of the word historically nor outside of the highly specialized field within intensional logic of possible worlds semantics, but rather a recent, technical, and highly contested concept.

Although a basic synchronic concept of possible worlds is frequently attributed to Leibniz (possibly with roots in early fourteenth century Scholasticism; see Knuuttila 1993, 2003, Wyatt 2000), the modern 'contingency' derives from still older roots. Modal logic in general and possible worlds semantics in particular were very obscure

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[40] E.g., in Climo and Howells 1976, Elster 1978, essays in Tetlock and Belkin 1996, and Ferguson 1997. Sometimes references to possible worlds semantics are explicit, sometimes implied through reference to Saul Kripke, David Lewis, and others, and especially to Lewis (1973).

areas of modern philosophy until well into the twentieth century,[41] while the common English language term 'contingency' has long held both popular and academic meanings related to the concept of 'conjuncture' and derives from the Latin *contingere* from *con tangere*, 'to touch closely' or 'border on'. Other words from the same root are 'contact' and 'contiguous' (Oxford English Dictionary).[42]

Although many social scientists make explicit references to synchronic possible worlds semantics, we do not believe they are actually working within a true synchronic possible worlds framework or synchronic contingency. There are three reasons for this assertion.

A first indicator that social scientists (this example is often associated with Gould and biology as well) are using a non-synchronic meaning of contingency is that allusions are frequently made to 'rewinding the tape'. As illustrated in Figure 3.2, in a synchronic view of possible worlds there is no need to consider going back in time to consider alternative possibilities (hence the term 'synchronic').

A second indicator that social scientists are using a non-synchronic meaning of contingency is that discussions of determinism and indeterminism are almost always found in social science (and biological) considerations of contingency. This is evident in the association of contingency with chance and free will in examples from Section 3.2. There are countless remarks such as '[s]ynonyms for our usage [of chance] include the philosophical concepts of "accident" and "contingency", [and] "indeterminism", "near-determinism"' (Manis and Meltzer 1994, 45) or claims that '[c]ontingency represents a third domain, between the determined and the random' (Blaser 1999, 415).

As illustrated in Figure 3.1, when dealing with only one actual world (as in diachronic contingency) any discussion of multiple possible outcomes *necessarily* entails indeterminism, while as illustrated in Figure 3.2, the concept of indeterminism

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[41] It was not until after the increase in attention to modal logic more generally following C.I. Lewis in the early twentieth century that the subsequent development of modern possible worlds semantics could even occur (built on in the 1950s and 1960s, following the work of Rudolf Carnap, by Jaakko Hintikka, Stig Kanger, Dagfinn Føllesdal, Richard Montague, Saul Kripke, and David Lewis among others).

[42] One can imagine a possible etymology where two things that come together or come into contact alter each other's course giving a 'contingent' outcome. 'Contagious' and 'contagion' also stem from the same Latin *contingere* and *con tangere*. Indeed, disease and epidemics (and disasters more generally) are still cited as prime examples of contingent events, with the common usage 'to prepare for any contingency' or 'contingency planning' reflecting this usage.

is superfluous in a synchronic view of contingency. Indeed, there is a complete absence of references to indeterminism in most discussions of modern synchronic modal logic. Terms related to indeterminism such as 'indeterminism', 'determinism', 'free will', 'agency', 'chance', 'randomness', 'probability' or 'stochastic' have no mention at all in the indexes of key works on synchronic possible worlds semantics such as Loux 1979, Forbes 1985 and 1989, Chihara 1998, Divers 2002 nor in many other similar works. The frequent discussions of indeterminism by social scientists when considering contingency and counterfactuals, unnecessary in possible worlds semantics, suggests that a synchronic meaning of contingency is not truly intended in these works.

Finally, and perhaps most tellingly, there is a constant emphasis on *plausibility* in the social science literature on counterfactual contingency (e.g., Hawthorn 1991, Tetlock and Belkin 1996, Ferguson 1997). Plausibility is a concept that has little meaning in possible worlds semantics and synchronic contingency. In infinite synchronic possible worlds, *everything*, if possible at all, is plausible. Possible worlds semantics explore the meanings of truth, necessity, and possibility, not of plausibility.

These three factors – the common references to 'rewinding the tape', the common association of contingency with discussions of indeterminism and determinism, and the frequent reference to the need for 'plausibility' all suggest that in practice, despite conventional and seemingly obligatory references to Lewis (1973) and possible worlds in recent decades, the contingency referred to and relevant to the social science of the actual world is not of the synchronic type.[43] Whatever use possible worlds semantics may have in the esoteric field of modal logic, it does not, and cannot, tell social scientists the things they want to know about the actual world.

Eliminating the synchronic possible worlds semantics class of contingency leaves us with two classes, diachronic and deterministic contingency. We believe that to assert that one or another of these meanings of contingency is correct is tantamount to taking a position in the 'no hidden factors' argument regarding indeterminism.

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[43] One of the few exceptions to this assertion we have found - where synchronic contingency *is* clearly meant - is Sylvan and Majeski (1998). We leave it to the reader to decide if the use of synchronic contingency/possible worlds semantics adds anything useful to this work. It seems to us that discussion in terms of synchronic possible worlds only transfers the labyrinthine and convoluted arguments of this branch of intensional logic with its innumerable unresolved (irresolvable?) problems to the already difficult realm of the social sciences.

A common example of a no hidden factors argument is that of roulette. One might believe that a large win at roulette is a (diachronically) contingent event, with the win due to ontological chance. But although the minute factors of the spin of a roulette wheel and the toss of its ball might be *epistemically* impossible to trace, this may not be true *ontologically*. The perceived 'chance' could just be ignorance of imperceptible hidden factors.[44] An ostensibly diachronically contingent event such as winning at roulette might actually be a deterministically contingent event where the conjunction of hidden factors (that is, the 'context' of the roulette ball) gives a particular outcome.

When the term 'contingent' is used, because it can possibly be either diachronic or deterministic, its use serves to obscure an author's stance on these issues.[45] This becomes a problem when the concept of contingency is central to the interpretation of arguments as has increasingly been the case in recent decades in works as diverse and influential in their fields as the those on comparative development in our introduction (e.g., by Goldstone, Scott, and Wong) and in biology, psychology, and other fields (e.g., Gould, Shermer, etc.).

Given the salience in recent years of the concepts of conjuncture (e.g., Little 2000, O'Brien 2000), open systems (e.g., Bhaskar 1975, Sayer 2000, Cartwright 1999, 2002a, 2002b) and their necessary component of 'exogenous factors',[46] we find the deterministic class of contingency, related to all of these concepts, especially intriguing. The close relationship of contingency to debates in the social sciences and the philosophy of science (Chapter 2 and above) on opens systems (or *ceteris paribus* clauses [Cartwright 2002a; Earman, Roberts and Smith 2002] or 'provisos' [Lange 1993; Earman and Roberts 1999]), laws of nature, and exogenous factors makes the

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[44] This argument is of course at the heart of debates on quantum indeterminacy, where it is thought that true ontological chance exists, although heterodox positions believe that there may be hidden factors in this case as well. Earman (2004), however, shows that even in mainstream quantum physics the commonly held conception that indeterminism has been definitively shown is incorrect. In a careful survey of the topic asking the question 'If we believe modern physics, is the world deterministic or not?' Earman concludes that 'there is no simple and clean answer' (Earman 2004, 43).

[45] We discussed the popular but disputed concept of path dependency above, noting that part of its difference from the concept of contingency is that it has a built-in association with increasing returns. Another problem is that the term also serves to hide assumptions concerning determinism and indeterminism. Imagine the Polya Urn Process again - on each draw, the fact that one or another color ball is drawn could be due *either* to hidden factors *or*, in the view of some, to ontological chance.

[46] Recognizing 'open systems' and 'exogenous factors' as two sides of the same coin would allow the literature on each concept to be conceptually unified for a clearer understanding of both.

deterministic concept of contingency especially worthy of further study and clarification.

3.5.1 Contingency and human action

Chapter 5, initially conceived before (and motivating) the present chapter, observes that when considering uses of the word 'contingency' in the social sciences as a group, one finds that it is commonly seen as the result of two things, either 1) from geographical influence (or 'context') on human events or 2) the result of human action.

In this chapter we have narrowed the classes of contingency down to two, a first class where contingency is the result of ontological chance or free will and a second where what is described as contingency is the result of the conjuncture of separate causal streams or 'systems' (or, as it is often described, of a 'system' and an 'exogenous factor'). For the social sciences it is especially important to make clear what assumption is being made: is contingency arising from human actions diachronic contingency or deterministic contingency?

Essentially this discussion is the same as that of roulette above. Human actions might either be the result of free will and thus an example of diachronic contingency (with the freely willed action represented by point 'y' in Figure 3.1). Or it may be the result of hyper complex spacetime interaction of factors (genes, environment), so complex as to make the interactions leading to human actions impossible to understand (like the roulette ball, although far more complex still).

As with quantum physics, there are debates within neuroscience as to whether there is free will or whether there are hidden factors (including at the quantum level) that account for human action. After a survey on this question Weber concludes that 'for the time being it is necessary to set the record straight on indeterminism in neurobiology. At present, its prospects are not good' (Weber 2005, 672).

Human action is generally thought to be the result of some combination of 'nature' and 'nurture', that is, genetic inheritance and environment. The hyper complex interaction of these is conceivably sufficient to account for human actions yet sufficiently complex to render human action epistemically too difficult to understand.

What is of central interest here is that both long-term genetic development ('nature') and short-term environmental influence ('nurture') are plausibly ontologically the result of spacetime conjunctures, even if epistemically they are too complex to be easily understood in this way.[47] This brings even human action fully into the realm of deterministic contingency. This argument is not central to the current work, as the goal here is to understand how initial conditions as exogenous factors may be used in explanation and the spacetime histories of nature and nurture are epistemically too complex (although links are being made between genes, environment, and spatial explanation, for example in Cavalli-Sforza et. al. 1994 and related research; see also Section 5.7.1 below). Chapter 5 discusses in more detail how factors frequently described as contingent *can* be better used. However, it is important to at least realize

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[47] 'Nature', or a genetic view of behavior, is widely associated with determinism. Less appreciated, however, is that even pure 'nurture' is just as easily fully deterministic. The spacetime biography of every individual could in theory be traced unbroken back through their life and on to their ancestors with no need for any appeal to indeterministic forces.

The view that an alternative to 'nature' and genetic determinism is tantamount to an appeal to biography can be found, for example, in Remmel 2006. Developmental Systems Theory is an approach to developmental psychology that has in recent years developed as an alternative to 'nature' oriented evolutionary psychology (notably, a key volume in Developmental Systems Theory, Oyama 2001, is titled *Cycles of Contingency*). 'Developmental systems theorists criticize evolutionary psychology's model of development…as overly deterministic. However, developmental systems theory can be criticized as not deterministic enough. By emphasizing the unique complexity of every individual, the theory risks reducing psychology to biography.' (Remmel 2006, 176). *Contra* Remmel, however, the biography of biological entities, including humans (and including neurobiology, see Weber 2005), can be thought of as what physicists call 'world lines', and world lines can be thought of as fully deterministic (Burock 2004). Every biological organism is what has been called an 'historical individual', with an utterly unique genetic make-up resulting from very long-term processes, and a unique world line or biography over the short-term. Every biological entity is 'spatio-temporally localized i.e. historically unique kinds of entities about which only idiographic rather than nomothetic statements can be made…This is now all so well understood that I only refer readers to the existing literature (for an elementary introduction see Callebaut 1993, 278-282; for some of the original literature see Ghiselin 1974, 1981; Hull 1976, 1978, 1984, 1989)' (Blute 1997, 354; one might cite the work of Richard Dawkins more generally as well). The idiographic statements that can be made about historical individuals are conceivably deterministic; Pred describes the concept of spacetime biographies: '[E]ach of the actions and events consecutively making up the existence of an individual has both temporal and spatial attributes. Consequently, the biography of a person can be conceptualized as a continuous path through time-space…the "biographies" of other living creatures, natural phenomena, and humanly made objects can also be conceptualized in the same manner' (Pred 1984, 281). These spacetime trajectories come together (conjuncture) to create 'space as historically contingent process' (282). It is conceivable that these trajectories, including in neurobiology, are the spacetime trends that result from irregular initial conditions with no necessary recourse to free will to explain human actions. The inevitable moral questions this concept of human action raises is the issue of the next chapter.

It is interesting though unsurprising that the view that individual spacetime biographies are in theory important to understanding social outcomes has been especially important in geography, stemming largely from the work of Torsten Hägerstrand, e.g., Carlstein 1981; Pred 1977, 1981, 1984, Kellerman 1989; Stjernström 2004; see also Richards, Bithell and Bravo 2004. However, as similarly noted in the Preface to the dissertation, the reality of the complexity of the social realm seems to severely limit the study of society in this way.

the potential for the spacetime trajectories of matter resulting from irregular initial conditions to unify concepts of explanation. As noted in the Preface of the dissertation, it is important to have a *theoretically* correct concept of explanation regardless of what the implications of this are for the possibility of knowledge of certain domains. The inevitable moral questions this concept of human action raises is the issue of the next chapter.

3.5.2 Conclusion

In this chapter we have attempted to show three things. First, we demonstrate that there are at least eight common uses of the term 'contingency' in the social sciences and illustrate this diversity with numerous examples drawn from the social sciences and history. We hope this alone is useful in highlighting the high possibility of misinterpretation when using the word. Second, we develop a classification system for the concept of contingency based on assumptions about possible worlds and indeterminism. Doing so allows for the metaphysical commitments of the various uses of the term 'contingency' to be more evident, and helps to show the relationship of the many uses of the concept of contingency to each other and to other important concepts such as indeterminism. Finally, we discuss and critique the three classes of contingency in greater detail. Our main finding is that one of the three classes, synchronic contingency, although widely found in the social sciences, is a concept that is of little use beyond its specialization of possible worlds semantics within modal logic. The remaining two types of contingency, diachronic and deterministic contingency, are in fact nothing more than a variety of the 'hidden factors' argument in the determinism/indeterminism debate. Our conclusion is that in most cases the word 'contingency' is better avoided. We also find that its relationship to the concept of 'open systems' and exogenous factors is especially interesting and in need of further elucidation. If Gould is correct that in the historical sciences 'the science of contingency must ultimately be integrated with the more conventional science of general theory' (Gould 2002, 46), then these issues surrounding contingency must be clarified and resolved.

CHAPTER 4
DETERMINISM AND THE ANTIQUATED DEONTOLOGY OF THE SOCIAL SCIENCES

The opposite of freedom is coercion, not determinism.

Sam Brittan (1998)

Explanation based on laws of nature in combination with initial conditions is generally associated with determinism. In the social sciences determinism has frequently been rejected due to the moral dilemmas it is perceived as presenting. This chapter considers this rejection in greater detail.

4.1 Introduction

The purpose of this chapter is to show that the social science rejection of hard determinism on moral grounds, largely complete by the mid-twentieth century, came just before a burst of creative development in consequentialist theories of social justice that *are* conceivably consistent with determinism (because they do not rely on intent or free will), a resurgence that has seldom been recognized in the social sciences. Thus the current social science view of determinism and social justice is antiquated, ignoring numerous common and well-respected arguments within philosophy that hard determinism can be reconciled with a just society. We support this argument with a purposefully concise[48] tracing of the parallel development of stances on determinism in the social sciences and the deontological-consequentialist debate in philosophy. The chapter concludes with a brief consideration of deterministic consequentialist ethics, social justice, and the problems of egoism and altruism.

[48] This is in order to avoid overwhelming the main point of the chapter with the unusually vast and contested literature and endless possible digressions concerning these subjects. Once the main point is understood, then of course future, more detailed debate is possible.

Before continuing it should be noted that the determinism discussed is hard determinism as defined below,[49] and that a similar argument could be made replacing our emphasis on consequentialism with an emphasis on compatibilism, i.e., that the many modern developments in theories of compatibilism also problematize the traditional social science moral rejection of determinism. We do not pursue this possibility because we do not find compatibilist arguments convincing—we doubt there is a way to reconcile a meaningful concept of free will with determinism. Nevertheless, compatibilist theories also call into question the self-assuredness of the social science moral rejection of determinism.[50]

Why bother with determinism at all when the physical sciences seem to have shown that even the world of physics is indeterministic, much less the biological and social realms? Simply because it is not nearly as clear that physics has shown the world to be indeterministic as one might think if reading only social science references to quantum physics. In fact, even the *standard* interpretation (i.e., *not* just heterodox interpretations such as the oft-cited Bohm interpretation) of quantum mechanics by no means incontrovertibly shows that the universe is fundamentally indeterministic. In a careful survey of the topic asking the question 'If we believe modern physics, is the world deterministic or not?' John Earman concludes that 'there is no simple and clean answer' (Earman 2004, 43). After a similar survey on indeterminism in neurobiology, Marcel Weber concludes that 'for the time being it is

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[49] We use a common definition of determinism in Vihvelin (2003, para. 5): 'the thesis that a complete description of the state of the world at any time *t* and a complete statement of the laws of nature together entail every truth about what happens at every time later than *t*. Alternatively, and using the language of possible worlds: Determinism is true at a possible world *w* iff the following is true at that world: Any world which has the same laws of nature as *w* and which is exactly like *w* at any time *t* is exactly like *w* at all times which are future relative to *t.*' The high degree of acceptance of a moral rejection to determinism in the social sciences (Section 4.2 below) demonstrates that most social scientists are libertarian incompatibilists, i.e., (metaphysical) libertarians and the determinism they object to 'hard' determinism. That is, they do not believe free will and determinism are compatible and so are not compatibilists, and since they believe in free will they reject incompatibilist hard determinism (the belief in determinism at the expense of free will).

[50] It is important to note that, confusingly, the view is sometimes found (e.g., Mason 2005, 344) that compatibilism is determinism compatible with morals rather than the more common view that compatibilism is determinism compatible with free will *and thus* morals. We believe the former view makes it difficult to distinguish between several common combinations of determinism, free will, and morals: 1) (hard) determinism with no free will and no morals, 2) (hard) determinism with no free will but that is somehow moral (or more precisely, ethical, with an ethics emerging from the self-interested actions of many individuals, discussed in the Addendum) and 3) determinism *with* free will *and thus also* morals. It seems clearer to consider the first two of these both 'hard determinism' (and then debate the possibility of an *ethical* hard determinism) and the last of these as 'compatibilism'. Of course, it may not matter – Koons (2002), for example, argues that in practice an ethical hard determinism and compatibilism are identical.

necessary to set the record straight on indeterminism in neurobiology. At present, its prospects are not good' (Weber 2005, 672). And while there has been a pronounced emphasis on free will and agency in the social sciences in the last half century, without a neurological basis for indeterminism it seems difficult to account for where something truly 'free' enters into the question of human action. Moreover, *even if there is* ontological chance in physics, this may not 'percolate up' and make the biological realm indeterministic (see, for example, Millstein 2000 and 2003, especially on the concept of 'asymptotic determinism'). With no appeal to free will or indeterminism, some combination of nature and nurture, both of which are conceivably deterministic (Section 3.5.1), and their astonishingly complex interplay may be sufficient to account for human action.[51]

In recent decades, due in part to positions on supervenience and physicalism, doubts about free will have been common among philosophers, especially the (metaphysical) libertarian free will that pervades the social sciences. Koons notes that '[m]ost philosophers now concede that libertarianism has failed as an account of free will' (Koons 2002, 81) and Smilansky that 'metaphysical or libertarian free will, is highly contentious and, as many believe even incoherent. To pin the hopes of egalitarianism on libertarian free will would be suicidal.' (Smilansky, unpublished, 4). Comparing these views with those on free will and agency in the social sciences gives an idea of the divergence of the social sciences from many modern philosophical perspectives on free will. In sociology, for example, Wright notes that 'the last few decades have witnessed a pronounced shift in thinking towards agency arguments. Over the last 25 years, a variety of theoretical perspectives—including ethnomethodology, hermeneutics, phenomenology, rational choice theory, the

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[51] When, if one looks for the *precise details* beyond a vague 'free will' for what motivates human action in philosophical and ethical discussions (if they are mentioned at all, which often they are not), one finds only nature, nurture, or some combination of both as the motivators. As just one example, in Rawls' *A Theory of Justice* (1971) humans are morally motivated by "nature" e.g. (all emphases added), 'the effort a person is willing to make is *influenced by his natural abilities and skills*…The *better endowed* are more likely, other things equal, to strive conscientiously, and there seems to be no way to discount for their greater good fortune' (312) and 'Moral learning is…the free development of our *innate intellectual and emotional capacities according to their natural bent*' (459). Alongside these 'nature' causes of human action, 'nurture' causes are found, e.g., 'the willingness to make an effort, to try, and so to be deserving in the ordinary sense is itself *dependent upon happy family and social circumstances*' (74) and 'by the approbation and disapprobation of parents and of others in authority' (458). Both nature and nurture combined can be found as well: 'moral sentiments are likely to bear the scars of this *early training* which shapes more or less roughly our *original nature*' (459). There is no appeal when the details of human action are considered, however, to any causes of human action *other* than nature and nurture.

sociology of knowledge, the sociology of sociology, and structuration theory—have caused a virtual transformation toward agency in sociology.' (Wright 1995, 8).[52] In the social sciences determinism has been replaced with what David Harvey speaks of as a ubiquitous 'triumphalist humanism that underlies so-called "possibilist" doctrines of economic development and change' (Harvey 2001, 228). Arguing against 'sociocultural evolutionism' Bryant reiterates the view, widespread in the social sciences, that agency and free-will mean that we must study the social realm as 'in Durkheim's classic formulation, a reality sui generis, a distinctive and emergent ontic plane that requires its own indigenous categories and principles of explanation' (Bryant 2001, 468).

Section 4.2 supports the main contention of this chapter through a (purposefully brief) tracing of the development of stances on determinism in the social sciences and the parallel deontological-consequentialist debate in philosophy. We show how the social sciences first rejected determinism on moral grounds and then subsequently ignored the numerous later developments in consequentialist ethics that might have undermined the self-assuredness of this rejection. Section 4.3 concludes the main argument, and is followed by a compendiary addendum (Section 4.4) that outlines views on how deterministic consequentialist theories might conceivably be argued to account for the development of a just society.

4.2 The Deontological - Consequentialist Debate in Philosophy and the Moral Rejection of Determinism in the Social Sciences

Deontologism is an ethics based on moral obligations and intent (and thus free will), traditionally contrasted with utilitarianism (since the mid-twentieth century more broadly conceived of as 'consequentialism', the belief that it is the consequences of actions that matter rather than intent). Because consequentialist ethics do not rely on intent or free will they are conceivably consistent with hard determinism (although consequentialists do not necessarily believe hard determinism to be true) while the moral basis of deontological ethics makes them fundamentally

[52] We are aware that there are arguments that distinguish free will from agency. However, this does not affect the discussion here. Where agency is used synonymously with free will it falls within the scope of this discussion. Where it is explicitly defined as something other than free will, then it does not.

opposed to hard determinism. The deontological-consequentialist debate was long defined by Kant and Locke (deontological) and Bentham, J.S. Mill, and later Sidgwick (utilitarian) from the seventeenth century to the mid-twentieth century.

4.2.1 The early twentieth century rejection of determinism in the social sciences

While within philosophy the deontological-consequentialist debate developed the 'social sciences' began to emerge in the nineteenth century. Various strands of the young social sciences incorporated ideas viewed as deterministic, especially environmental/geographical determinism and various types of biological determinism (Social Darwinism, 'nature' views of the mind). We will focus on geographical/environmental and biological determinism here. Although other uses of the term 'determinism' are also frequently encountered in the social sciences, such as 'technological determinism', 'economic determinism', 'cultural determinism' (and more generally in recent decades, 'social constructionism') and so forth these are clearly not really examples of determinism; it is evident that economies, cultures, technology etc. are each influenced by myriad other factors and are thus not themselves ultimately determinate—technology is clearly in part 'caused' by culture, economies changed by technology, culture by economics and so on (in what might be called 'circular endogeneity').[53]

The various strands of determinism, especially environmental and biological determinism, found in the young social sciences began to be rejected in the early twentieth century, a process virtually complete by mid-century. By 1951 geographical determinism could already be declared 'as dead as the dodo' (Dickinson 1951, 6). Likewise with biological determinism, whose rejection 'reached its zenith in the 1950s, in the aftermath of the Nazi atrocities, but in some corners of philosophical inquiry [its rejection] took hold much earlier. In psychiatry the fashion was turning against biological explanations around 1900' (Ridley 2003, 98).

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[53] It seems that it is precisely the prima facie *plausibility* of environment or biology to be ultimate causes determinate of later social development that accounts both for their attraction and repudiation. This prima facie plausibility is evident, for example, in the way that environmental and biological determinism circle back to the issue of free will through the question of human action and the 'nature'(biology)/'nurture'(environment) debate, where human action has time and again been suggested (or feared) to be ultimately caused by either environment or biology. We cannot help but point out the inconsistency of the rejection of environmental influence in the study of society as 'environmental determinism' and the simultaneous widespread embrace of environmental influence in the nature/nurture debate.

Although there was an important boost to the rejection of determinism in the social sciences from quantum physics, again and again we find moral reasons for the rejection of environmental and biological determinism.[54] The moral objection is clear in the wording of objections to geographical and environmental determinism, which are 'treated as part of geography's distant and shameful past' (Frenkel 1992, 144), 'remembered with shame' (Godlewska, 1993, 550) and equated with 'Original Sin' (Buttimer 1990, 16). 'Of all the various chapters in the development of modern geography, none has been more disparaged, indeed vilified than the discipline's relatively brief engagement with the doctrine of environmental or geographical determinism in the nineteenth and twentieth centuries' (Bassin 1992, 3). Likewise, moral reasons lay at the heart of the social science rejection of biological determinism: 'During most of the twentieth century "determinism" was a term of abuse, and genetic determinism was the worst kind of term' (Ridley 2003, 98). Views such as those of Isaiah Berlin on determinism became conventional wisdom, that it 'had dangerous moral and political consequences, justifying suffering and undermining respect for the "losers" of history. A belief in determinism served as an "alibi" for evading responsibility and blame, and for committing enormities in the name of necessity or reason.' (Cherniss and Hardy 2006). Indeed, the moral objection to hard determinism is still so strong that even within philosophy 'many philosophers seem to reject it not because of its philosophical implausibility, but because they fear the consequences of its being true.' (Koons 2002, 81).

4.2.2 1950s to the present: Determinism as dead letter

From mid-century to the present little has changed in positions in the social sciences on determinism. Geographical determinism is rarely encountered, viewed as it is as an idea long ago rejected. For example, Lewis and Wigen (1997) admonish:

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[54] The development of quantum physics would also reinforce the rejection of determinism. However, as evidenced by the quotes in this paper and many more like them, overall in the social sciences one finds more and earlier examples of the rejection of determinism on moral grounds than on the basis of quantum physics. The other most common rejection of determinism is that it is overly simplistic to attempt to explain highly complex outcomes as deterministically resulting from relatively simple earlier factors such as geography (e.g., the Lewis and Wigen quote below). Accepting this viewpoint, however, obscures precisely what is one of the most interesting aspects of explanation – explaining the emergence of complex outcomes from relatively simple antecedent states. Chapter 2 discussed the explanation of complex outcomes arising deterministically from simple initial conditions.

> For late twentieth-century Americans to sustain belief in a sweeping fit between cultural and natural features requires turning a blind eye to the most basic findings of geographical research….Human history is no more molded by the rigid framework of landmasses and ocean expanses than it is determined by the distribution of 'ideal climates' (Lewis and Wigen 1997, 45, 46).

A modern paper that ventures to consider how geographical factors might influence economic outcomes (Gallup, Sachs, and Mellinger 1999) is condemned (in the inaugural issue of a journal, no less, whose stated goal is to 'reinvigorate the intersection between economics and geography') as 'breath-taking environmental and spatial determinism' that should be corrected by other scholars, i.e., geographers that 'have at least as much to teach economists as they have to learn' (Sheppard 2001, 135), apparently meaning the conventional wisdom rejection of geographical determinism and that environmental factors are off limits in the study of society. Tellingly, this rejection comes immediately after a call to 'avoid the temptation to dismiss out of hand what [one is] skeptical of' (Sheppard 2001, 135). Environmental determinism is clearly considered so thoroughly rejected that this admonition does not apply to it.

Similarly, biological views of society such as evolutionary psychology are still widely rejected for their determinism. Deterministic evolutionary psychology with its 'stress on human universals and on innate behavioral differences between the sexes simultaneously conflicts both with the left's current preoccupation with diversity and multiculturalism, and with its feminism.' (Grosvenor 2002 436). Thus impeached, evolutionary psychologists themselves even seek exoneration from the epithet of determinism: 'Neither Dawkins nor any other sane biologist would ever dream of proposing that human behavior is deterministic' (Pinker 2002, 112).

The modern rejection of determinism has not only continued since the 1950s. It has remained based on the same moral reasoning of the early twentieth century. Like Sachs' work mentioned above, the few forays into what are considered deterministic arguments that do occur are attacked, sometimes vehemently, in a way only moral indignation can provoke. For example, Jared Diamond (1997), like Sachs, suggests environmental factors are important in economic development. This 'deterministic' explanation of global development patterns is chastised as a 'pernicious book' that except for the popular attention it has received 'would not ordinarily merit scholarly

discussion' (Sluyter 2003, 813). Diamond's (deterministic) 'junk science' is seen as so morally dangerous that it 'demands vigorous intellectual damage control' (Sluyter 2003, 813). Regarding biological determinism, Pinker notes that '[t]o acknowledge [a perceived deterministic] human nature, many think, is to endorse racism, sexism, war, greed, genocide, nihilism, reactionary politics, and neglect of children and the disadvantaged… Any claim that the mind has an innate organization strikes people not as a hypothesis that might be incorrect but as a thought it is immoral to think' (Pinker 2002, viii). 'Progressive' or 'left' intellectuals interpret 'deterministic' evolutionary psychology 'as part of the broader assault on collectivism and on the prospects for more cooperative and egalitarian social models' (Grosvenor 2002, 436) and view determinism 'as a flawed scientific rationalization of prevailing [unethical] social hierarchies.' (Grosvenor 2002, 438).[55] The eminent primatologist Sarah Hrdy even questions 'whether sociobiology should be taught at the high-school level…Unless a student has a moral framework already in place, we could be producing social monsters by teaching this.' (quoted in Barash, 2006, B13).

4.2.3 The mid-century reinvigoration of ethics

The period following the early- to mid-twentieth century demise of geographical and biological determinism in the social sciences saw a remarkable reinvigoration of the study of ethics and related issues of social justice among philosophers and political theorists. This resurgence in part was stimulated by G.E.M. Anscombe's influential article 'Modern Moral Philosophy' (1958) which both introduced the term 'consequentialism' now used to describe the broad range of ideas descended from classic utilitarianism and introduced a 'virtue ethics' as an alternative to both deontologism and consequentialism. A number of important consequentialist viewpoints followed, such as Smart (1961), Hare (1963), Lyons (1965) and Bayles

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[55] Although overt rejection of determinism on moral grounds is frequently from the 'left', we do not mean to imply that determinism is somehow morally accepted by the 'right' (nor, by extension, that our views are somehow on the 'right'). Indeed, the almost total banishment of the concept from the modern social sciences is likely due precisely to the fact that *its rejection is one of the few areas where both right and left seem to be in agreement*. The religious right objects to determinism (and its twin concept, reductionism, see Wacome 2004) based on beliefs that it undermines religion, while they as well as the conservative and social right (Berlin, Hayek) and (political) libertarians reject strongly to the determinism that was frequently associated with totalitarian regimes in general (Nazi and Stalinist especially) and with Marxism. In the twentieth century, determinism had few friends, and, remarkably and almost uniquely among scientific ideas, was reviled by social scientists of virtually all political persuasions, left *and* right.

(1968). Contemporaneously a type of consequentialism known as 'rule consequentialism' was also developed, according to Hooker (2004) first clearly formulated by Urmson (1953) and Brandt (1959). Little over a decade after Anscombe's seminal article another work widely considered one of the most important treatises on normative ethics and social justice since the period of Kant and Locke was published, Rawls' *A Theory of Justice* (1971). This extraordinarily influential work increased still further the attention to social justice and topics related to the deontological-consequentialist debate that had already noticeably increased in the period since Anscombe's article.

4.3 Discussion and Conclusion: Modern Consequentialism and Social Justice

We have briefly outlined how, since the mid-twentieth century rejection of determinism on moral grounds in the social sciences, numerous consequentialist theories of ethics and social justice (consistent with hard determinism because they do not rely on intent or free will) flourished while the social sciences nevertheless rejected determinism as if these did not exist. We should note (as Rawlsian approaches so pervasively shape modern debates on ethics) that Rawls himself considered his argument to be in opposition to utilitarian arguments. Nevertheless, *A Theory of Justice* stimulated still further attention to ethics and the development of consequentialist ideas, leading to still more nuanced and robust consequentialist viewpoints (Shaw 1999 provides a readable yet thorough modern overview and defense of utilitarianism). Furthermore, it is debatable whether or not Rawlsian approaches to ethics are truly anti-consequentialist. As just one example, note the common observation that Rawls justifies income inequalities based on the benefits (consequences) they incur. More generally, ostensibly deontological ethics might be considered consequentialist in the sense they are ultimately judged 'good' due to their positive consequences for society. On the historical and institutional view deontological moral 'rules' might just be entrenched customs that became judged as good based on long forgotten consequentialist grounds. Even Kantian ethics, traditionally considered the epitome of deontologism, might be interpreted as consequentialist for these and other reasons (Cummiskey 1990; Hare 1997). Indeed, Portmore (2007) argues that *all* deontological theories can (and should) be

'consequentialized'. (There are also arguments that Kant can be interpreted as a compatibilist, e.g. Hudson 1994; Vilhauer 2004 further discusses this argument). Additionally, Anscombe's 'virtue ethics' have seen the development of at least one deterministic variant, (Slote 1990), and Smilansky even argues for 'The ethical advantages of hard determinism,' the title of his (1994).

In light of these and many related developments and possibilities regarding consequentialism it would seem that the self-assuredness of the social science rejection of determinism on moral grounds is misleading and irresponsible. Bald assertions that determinism is incompatible with social justice, so common in the social sciences, are misleading because they give the appearance that this is undisputed when this is far from the truth. They are irresponsible when they ignore the scores of contrary arguments that are, if not universally accepted, at least well-respected by experts on ethics, justice, and free will. To authoritatively reject determinism on moral grounds one would need to demonstrate that deontological arguments are superior to consequentialist arguments.[56] However, consequentialist arguments clearly remain on equal footing with deontological arguments among philosophers and political theorists. The numerous developments in consequentialist theories of social justice compel the conscientious social scientist to remain at least agnostic on the issue of determinism in the social sciences on moral grounds.

4.4 Addendum: A Note on Social Justice and Determinism

The purpose of this chapter has been to show that there are many respected arguments for consequentialist ethics (which are potentially consistent with hard determinism because they do not rely on intent or free will) and that these are irresponsibly ignored by social scientists. Thus our purpose has not been to actually defend the possibility of a consequentialist ethics. However, the reader might reasonably ask: How might there be a just society when individuals are not responsible for their actions in the sense implied by the concept of free will, and are

[56] Alternatively, as noted in Section 4.2, social scientists might base their rejection of determinism on other arguments such as 1) quantum indeterminacy or 2) as being overly simplistic. However, 1) the most comprehensive recent considerations of physics and determinism finds no clear reason to believe modern physics shows the world to be either deterministic or indeterministic and 2) as Chapter 2 discusses, there have been recent developments in physics and other fields that demonstrate the plausibility of the deterministic development of the complexity of the world from the simplest of initial conditions.

motivated only by self-interest? There is of course no space to fully consider this question here, but it is perhaps useful to highlight a few relevant points.

To consider how there might be a just society without resorting to deontologism and free will, let us consider two fundamental deontological criticisms of consequentialism. One way in which consequentialism can be divided is into individual-oriented consequentialism, i.e., egoism, and group-oriented consequentialism, such as classical utilitarianism ('the greatest good for the greatest number'). Deontologists argue that neither of these can be just without morals. Under egoism there is no room for altruistic behavior and cooperation; society would be under the proverbial 'law of the jungle'. Conversely, in group-oriented consequentialism there would be no moral 'brakes' on what an individual is expected to sacrifice for society. This is the classic 'organ transplant' argument: that society would be justified in sacrificing an individual to use their organs in order to save five others.[57]

The problem of altruism is especially difficult for a non-deontological understanding of society. Early responses by evolutionary psychologists were based on kinship, with apparently altruistic acts actually a way of assuring the success of a genetic lineage. However, these were criticized for not being able to account for the full extent to which large, non-kinship based societies cooperate. From these early efforts explanations of altruism have developed and become both more nuanced and more engaged with and by the philosophical debate on morals (evident, for example in Joyce 2006 and de Waal 2006, the latter which includes responses by philosophers Peter Singer, Christine Korsgaard, and Philip Kitcher). Recently there has been the development of the concept of 'altruistic punishment' that sheds some light on the problem of prosocial behavior (e.g., Fehr and Gächter 2002; Boyd et. al. 2003; Gintis et. al. 2003; Fowler 2005. For a critique of Ferh's work on altruism and its significance for the social sciences see Peacock 2007). The long line of game theoretic approaches to altruistic behavior, whose promise was already being realized

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[57] Many of the arguments of this chapter could be written from the point of view of concepts of criminal law and justice. In such a paper the 'organ transplant' type argument and its political ramifications would be well represented by C.S. Lewis' well-known 'The Humanitarian Theory of Punishment' (1953). More generally, the significance of consequentialist (preventive) and deontological (retributive) concepts of justice are very well laid out in Robinson (1987) and citations therein. Robinson (2001) makes an interesting and subtle argument for why these concepts of criminal law should be both explicit and separately administered.

in works such as Skyrms (1996) are developing apace (e.g., Binmore 2005). The ferment in the study of altruism and cooperation makes this aspect of consequentialist ethics especially dynamic at this time. As with the social science rejection of determinism on moral grounds, this does not mean social scientists should not reject consequentialism because of the problem of altruism. But it does make it irresponsible to imply consequentialist theories *must* be rejected based on altruism when this is an ongoing area of research that is making significant advances.

This brings us to group-oriented consequentialism and the objection that there is no limit to how much society is justified in expecting individuals to sacrifice for the greater good. In the real world it is relatively easy to imagine how self-interest tends to work against this criticism. Much of the story of institutional and democratic development and enfranchisement is the story of individuals struggling to protect themselves from tyranny, including tyranny of the majority. Few if any accounts of the development of the institutions we associate today with a just society argue that these developed because pre-democratic states, empires, feudal lords, warlords, despots, kleptocracies, plutocracies, theocracies, or demagogues relinquished power or wealth because it was *morally right*. In accounts of the development of subsequent, relatively more just systems of representational government and institutions ranging from Marxist accounts (e.g. Moore 1966; Brenner 1976; Therborn 1977) to (political) libertarian (e.g. Hayek 1973; Benson 1991) to institutional, neoclassical, rational choice and other accounts (e.g. Elias 1939; Downs 1957; Olson 1965; North and Thomas 1973; Tilly 1975, 1990; Mann 1993; Spruyt 1994, 2002; Powelson 1994; Allum 1995; Ertman 1997; De Soto 2000; Acemoglu and Robinson 2005; Boix 2006; Greif 2006) morality plays no role. It does not seem to be the case that we *must* appeal to morals to see why individuals have struggled to limit utilitarian excesses. Hedonism will do.

CHAPTER 5 OVERVIEW OF THE CONCEPT OF 'ANCHORING' SOCIAL THEORY

Preface

Chapters 1-4 of this dissertation were concerned with the philosophy of science concerning the role of initial conditions in explaining contingent outcomes. Chapters 5-7 of the dissertation seek to understand how these concepts might be applied to the social realm, particularly the study of contingent, uneven development outcomes. As shown in Chapter 1, in the study of uneven development the role of initial conditions (early factor endowments, geographic context) has increasingly been of interest. However, there are a number of problems with the use of geographic factors as initial conditions in the study of society. We have already discussed their rejection based on moral concerns with determinism (Chapter 4). In addition to determinism, two closely related objections to the use of geographic factors in the social sciences are 1) the perception that they are overly simplistic – that monocausal explanations based on geographic factors cannot possibly have all the explanatory power attributed to them when social outcomes are so complex (e.g., Atkins, Simmons and Roberts 2000, 54; Coombes and Barber 2005) and 2) as ultimate causes; in the social sciences an R^2 of, for example, .6 or .7 is rare, meaning that assuming an argument is that A is influenced by B which is influenced by C and so on, there is no way to judge whether there is any influence after more than just a very few causal links.[58] Thus not only is an 'ultimate' cause objectionable on grounds of determinism, it is simply not meaningful to speak of long causal chains in the social sciences.

Geographers especially seem to fear being associated with 'simplistic' explanations based on geographic factors, of being identified with nothing more than 'neocolonial gazetteering, capes and bays, world capitals, and the socio-ecological determinism of *National Geographic* television specials' (Eliot Hurst 1985, 72). This attitude became so widespread within human geography that Stoddart complained that 'Geographers have forgotten—it is extraordinary to have to say so—that some parts

[58] For example, .6 x .6 x .6 x .6 = .13

of the Earth are high, others low; some wet, others dry; some desert, others covered by forest and grassland and ice' (Stoddart 1987, 331). This has been the case since at least the mid-1960s, when Morgan and Moss could already write of geography that 'In a study which claims to attach so much importance to the relationships between man and physical environment, the neglect of soil, human nutrition, and disease is extraordinary' (Morgan and Moss 1965, 340).[59] Hanson, in 'Healing the Rift Between the Nature-Society and Space-Society Traditions in Human Geography' (1999) asks 'Why did geographers think they could arrive at useful generalizations only by erasing nature? Some geographers see the answers to these questions in embarrassment over the discipline's earlier excesses of environmental determinism, i.e., that geography's previous bout with generalization had so prominently featured the role of the physical environment that geographic theory could regain credibility only by rejecting environment outright (Abler 1987; Fitzsimmons 1989; Kates 1987)' (Hanson 1999, 136).

However, we believe that properly used, and in light of a better understanding of the role of initial conditions in explaining spatial distributions and in the understanding of contingent local, context-dependent outcomes, geographic factors can be integrated into the study of society, and indeed that they have an indispensable role in taking the circularity out of aspatial social theories. This chapter considers attitudes among geographers, economists, and historians towards using geographic factors as initial conditions in explanation and how they might acceptably be used, in particular their role in 'anchoring' aspatial theories of social processes to real-world distributions.

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[59] In addition to the long-held rejection of geographic influence on society among geographers, there has also developed a rejection to the use of empirical data except at very small 'intensive' scales (case studies and usually small-scale survey data). 'Analysis of large data sets has become totally passé, the object of suspicion or even derision as "empiricist"' (Hamnett 2003, 2). Markusen notes the 'disdain for empirical work in the tradition of verification in much recent geographical writing' (Markusen 1999, 881) and Martin and Sunley that 'There is almost a disdain for in-depth empirical analysis (let alone hypothesis testing, which is dismissed as being identified with positivistic research and criticized for failing to reveal the detailed processes at work), whereas intensive, interview-based research is celebrated for its "explanatory depth."' (Martin and Sunley 2000, 154). Reasons include the rejection of mainstream economics, objections to definitions and operationalization of culture and institutions, and a more general rejection of 'cross-cultural' comparisons by both anthropologists and geographers based on Boasian 'historical particularist' assumptions and traditions. '[I]n their righteous indignation at the frequently both grandiose and incorrect formulations of the evolutionists, the cultural relativists virtually cast out the comparative method…each society became unique. The comparison of different societies, therefore, made no sense' (Udy 1973, 255).

5.1 The Standortsproblem and Geography's Focus on Process

> [T]he geographic method is concerned with examining the localization on the earth of any phenomena. The Germans have called this the *Standortsproblem*— the problem of terrestrial position—and it represents the most general and most abstract expression of our task. No one has yet written this philosophy of geographic localization, but we all know that this is what gives meaning to our work
>
> Carl Sauer, 1940 (Presidential address to the Association of American Geographers at Baton Rouge, Louisiana)

Central to this dissertation is the idea that a quest to understand where things are, to address the *Standortsproblem*, still does not have all the elements of a satisfactory 'philosophy of localization'. The problem of nomothetic approaches to contingency and unique situations must be addressed and emphasized if important questions of distribution and location are to be understood.

As discussed in the Introduction to the dissertation, a philosophy of geographic location must consist at a minimum of two components, one that deals with the forms and patterns that social processes might take, and a second that explains where these hypothetical forms and distributions will be in the real-world. 'Many attempts to relate [process and form] have, first, described form and secondly, inferred the process…much recent literature has argued that the best approach to explanation is to hypothesize process and then deduce form' (Norton 1982, 251). This quote on explanation of form in geography highlights a key characteristic of the discipline more generally: although a major question of geography is spatial *pattern*, the study of *process* is essential to answering this question. Social patterns are studied in order to infer the social processes that create them. Conversely, processes are studied in order to understand the patterns that derive from them (e.g. supply and demand associated with central place patterns; dependency and unequal trade to core and periphery; local cultures and institutions to regional success and failure and so on). In addition, some studies move back and forth between pattern and process and also work at different scales. This gives three basic types of study:

1) Study of process to understand form/distribution.

2) Study of form/distribution to understand process.[60]
3) Reciprocal iterations between '1' and '2'. This is especially associated with intensive and qualitative regional studies stemming from the work of Massey, and informed by the realism associated with Sayer (and more recently, 'cultural economy', e.g., Amin and Thrift 2003). The phrases 'structured and restructured' and 'produced and reproduced' are common to these approaches, that is, local variations influence general processes and vice versa, leading to a complex locally 'contingent' outcome.

The first two of these are straightforward concepts. The third, however, is more complex; it often gives the impression that location itself is being explained. Yet regardless of the scale or number of iterations, these types of studies do not *explain* real-world location/distribution, they only study it and its relation to processes in greater and greater detail (Chapter 1 and Section 5.2 below). The focus on process in these intensive and realist methods is clear from their description. For example, Lovering quotes Massey (1978) that the central task of 'restructuring' is to identify 'the *mechanisms* which produce specific spatial effects' (in Lovering 1989, 207, emphasis added by Lovering). The realist approach likewise focuses on process; Lovering writes that in the realist approach:

> the task of research is to provide an account of the way observable events are explicable in terms of deeper social processes…(Bhaskar 1979, Sayer 1982, 1984, Outhwaite 1987, Urry 1987). The restructuring approach attempts to explain geographical patterns as the visible manifestation of a set of less visible social

[60] It is worth noting that when social scientists other than geographers incorporate space into their work, this is often the reason. The classic example of this is John Snow's inference of the process of cholera transmission from the spatial distribution of cholera cases in London. GIS, ESDA, and visual analytics in general hold the promise of greatly increasing the study of space in this way; it seems that this is one of the areas where geographers have a great deal to teach other disciplines.

relations. A study of a specific case should be a window onto processes beyond (Lovering 1989, 213).[61]

The focus on process in the study of location is deeply ingrained in geographical thought. It is indicative of this that, for all their disagreement, one thing Hartshorne and Schaefer agreed on is that the study of real-world distribution meant the study of processes.[62] Schaefer, of course, famously argued that this systematic side of geography should stay within geography, while Hartshorne seemed to be happy to let other social scientists work on the spatial implications of social processes. (However, even Hartshorne wrote, in his most influential work, that 'In many cases, however, the geographer may find that the students of the appropriate ['systematic' social science] have not been interested in developing [principles governing distribution]. In such cases he can hardly be expected to wait indefinitely, but may have to undertake the study himself' [Hartshorne 1939, 418]).

5.2 The Lack of Spatially 'Privileged Independent Variables'

As noted above, the theoretical sophistication and intensive nature of geographic work on regional variation gives the appearance that the real-world pattern of

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[61] Eliot Hurst notes Samir Amin's (1976) critique of geography as 'simply spatially juxtaposing socio-economic phenomena, without the ability to understand and explain such patterns' (Eliot Hurst 1985, 67-68). Salih (1984) suggests that had Amin followed the 'outpouring of literature…on a geography of underdevelopment, regionalism and regional class formation, the spatial division of labour and the geographical transfer of value, the new urbanism and urban social movements or, more generally, socio-spatial dialectics, he would be more than satisfied that efforts are underway to correct geography's failure to fulfill its historical mission' (Salih 1984, 79). All of these, however, as well as the neoclassical spatial tradition focus on processes, and do not *explain* (beyond deducing certain patterns that should characterize processes or pushing the spatial explanation onto other social factors) real-world location/distribution.

[62] This refers to what is, within geography, a very famous debate in the 1950s ('the Hartshorne-Schaefer debate' concerning the fundamental goals, limits, and nature of geography) on which there is a large literature; see Livingstone 1992 and Dikshit 1997 for overviews. Hartshorne had a strong influence, moving geography away from the goal of explaining the location or distributions of things, in part through emphasizing that the influential, often philosophically grounded German geographer Alfred Hettner 'repeatedly and vigorously refutes the concept of geography as the study of distributions, the "Where" of things' (Hartshorne 1939, 418n) and concluding that

> In other words, though geography must know where things are, the study of the "Where" is not geography or an integral part of geography, and it is therefore not the function of geography to explain the "Where"—that is, to give the full explanation of why a phenomenon is found where it is found (Hartshorne 1939, 418).

variation itself is being explained. However, as discussed in Chapter 1, one of the more influential researchers into regional variation and agglomeration notes:

> there can be no invocation of a privileged 'independent variable' in the form of some prior fixed set of local activities or attributes…which are supposed to anchor the entire locational process within a more durable spatial matrix. Such a procedure would in any case only pose the problem again: What then accounts for the geographical pattern of *these* activities and attributes? (Scott 1984, 25).

In other words, in social processes all 'independent variables' are ultimately dependent on other factors, i.e., they are 'endogenous', and *their* spatial patterning needs explanation as well. More recently, in the currently popular qualitative, intensive methods, where institutional or cultural differences between regions are studied to understand how these lead to different regional outcomes (i.e., 'cultural economy'; see Amin and Thrift 2003), one researcher notes that it would be circular to argue that a study of this type has *explained* the variation that is studied: it is 'important to consider the provenance of the very institutions which we have implicated as having so much power to shape corporate and regional practices….[and] not to treat institutions as if they were…inherited from on high' (Gertler 1997, 57).[63]

Other researchers have commented on the problem of anchoring process. Peter Hall observes that a theorized process of agglomeration 'somehow lacks a first cause; it goes endlessly on, reproducing itself, but there is no suggestion as to the origins of change, either in the system itself or in its locational expression' (Hall 1998, 295). Sunley reiterates the views of Lovering (1989) that abstract generalizations cannot 'predict or explain empirical outcomes and the specific characteristics of places' and 'the difficulty of translating abstract ideas into specific outcomes' (Sunley 1996, 338-339).

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[63] This suggests that understanding differential regional economic outcomes in turn depends on understanding institutional or cultural variation, an unresolved problem central to anthropology and sociology in addition to geography. However, the problem of *explaining* as opposed to *studying* variation is generally avoided by these disciplines as well. Many approaches seek to 'explain' social behavior, such as structuralism, cognitivism and other idealist research strategies, as well as sociobiology; these argue that human behavior can be explained through either innate mental aspects of human beings, or genetic aspects in the latter case. However, regardless of the merit of these approaches to understanding society, because they are all based on human *universals* they all are only able to explain *similarities* in behavior, not variation. The cultural ecology of Steward addressed some of these issues yet faded from prominence (useful discussions of relations between anthropology, cultural ecology and geography include Winterhalder 1980, Denevan 1983, and Zimmerer 1994, 1996).

5.2.1 Conventional wisdom on the study of location

Conventional wisdom in geography maintains that real-world location is messy and 'historically contingent'. This is so ingrained that it usually goes without saying; when it is occasionally recognized that some explanation for the real-world location of some abstract theory is desirable, the question is elided or advice is given to avoid the issue. For example, Scott and Angel write on industrial agglomerations that 'The main analytical issue here, however is *not so much how these centers came to be precisely where they are*, but how they subsequently grew quite systematically' (Scott and Angel 1987, 878, emphasis added). They gloss over the anchoring or *Standortsproblem* while advising more attention to process. Similarly, Lovering warns that 'Although spatial research is concerned with the local, it should not be devoted to tracing geographical particularities for their own sake, although this is a temptation' (1989, 213).[64]

Further examples show how the problem of real-world location is recognized but seldom dealt with. Martin (1999) criticizes a deductive process-centered approach, the 'new' economic geography - whose models predict agglomeration and localization - for being 'unable to tell us *where* it actually occurs or why in *particular* places and not in others' (388, emphasis in the original). He goes on to argue that 'as economic geographers have repeatedly shown, economic processes operate differently in different places…These differences cannot be captured in terms of a model's "initial conditions", but themselves require explanation, not simply on a unique case by case basis, but in terms of more general principles of spatial difference' (Martin 1999, 389). Yet no further consideration of how to go about this follows; instead we again find explicit advice not to pursue location on a 'case by case' basis. In later work Martin, as others, elides the question of real-world location with vague constructions such as 'Different specific institutional regimes *develop* in different places' and '*Once established*, such local technological clusters in turn generate further specialized local institutional systems' (Martin 2000a, 80, 81, emphasis added). Regimes and clusters 'develop' and once established 'generate' but where this occurs is never accounted

[64] Smith, in 'Dangers of the Empirical Turn' (1987) worries that too much focus on the real will lead to narrow empiricism and a new sterile idiographic/nomothetic debate. The work he criticizes (i.e., the 'CURS Initiative'), however, is not representative of what is proposed here. It is empirical in the sense of focusing more intensively on local process. It generally does not, however, seek to explain the location of these processes except, again, through distributions of other endogenous factors.

for. Norton states 'all forms are necessarily the outcome of earlier forms and of process' (Norton 1982, 251), but goes on only to discuss the latter (process), not the creation of the former (earlier forms). The opening essay of *Regional Geography* (Johnston, Hauer and Hoekveld 1990) suggests that local/regional forms are contingent, and asks in its closing sentence 'So how are these contingent circumstances created, and how do people interact with them?' (8). Yet in the nine essays that follow, the first part of this question is not considered at all. The focus on process is almost total, even when the need to consider earlier forms and contingent context is explicitly addressed. How then, can processes be linked to real-world locations? Presumably doing so is important to understanding uneven development in more than an abstract and theoretical way.

5.3 Process, Contingency, and Real-World Location

It is useful in this context to consider as a class in themselves all examples in which social scientists have attempted concrete explanations of why a process is located or distributed where it is. By doing so, a surprisingly small number of factors are found to be recurrent.[65] While no panacea, systematizing what these factors are and how they have been used is a useful step towards a more complete understanding of how to explain real-world development patterns (continued in Section 5.6 below).

A systematic review of attempts to explain the real-world location of social processes (including the formation of industrial clusters, agglomerations, cities, trade routes and similar) shows that there are two broad classes of factors: 1) where location is the contingent result of human agency or actions; e.g. the location of St Petersburg or Madrid, the influence of political decisions, or the outcomes of wars, for example, or 2) is due to geographic or environmental factors. These are both frequently lumped together and described as 'contingent' and sometimes 'conjunctural' events. The first class, what might be called a 'Cleopatra's nose' type of contingency after the famous

[65] As noted in Chapter 1, an economist has recently asked 'Could the observed divergence in long-run economic performance across countries be attributed to differences in initial conditions? If so, can these initial differences be adequately characterized by a small set of variables?' (Tan 2003, 5). It seems, to a surprising degree, that the answer to the latter questions is 'yes'.

essay by the Cambridge historian J. B. Bury, is of course a subject of fundamental and long running debate among historians and not considered further here.[66]

It is interesting that human actions and geography are lumped together as 'contingent' considering the opposite association each of these commonly have with the concept of determinism. However, this is no coincidence. If there is such a thing as free will, then this is a source of exogenous variation to social systems; i.e. a privileged independent variable or an 'uncaused cause'; this has been deemed an acceptable, if problematic, explanation when it is invoked.[67] However, geographic variables are another source of exogenous variation,[68] yet since the exogeneity is not due to human choice they have not been popular; crucially, it is the very fact of exogeneity that leads to the rejection of geographic factors. For example, James Blaut states that the consideration of environmental factors 'is deterministic in the sense that it treats the environment as a separate, simple cause or "factor" not mediated by culture: something external to culture and influencing it from the outside' (Blaut 1993, 69). This exogeneity, though, is why geographic factors are usually implicated

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[66] These two types of contingency, resulting from free will and context (local constellations of factors) respectively, are discussed in greater detail in Chapter 3, Section 3.3 and 3.5. In the framework of Chapter 3, contingency resulting from free will is either diachronic or deterministic depending on assumptions concerning hidden factors in neurobiology (see Section 3.5.1), while the contingency of locality is 'deterministic' in the sense that it makes no necessary appeal to acausal factors (i.e., broken causal chains).

[67] The importance of unifying the concepts of free will/agency explanations and geographic explanations is perhaps demonstrated by the fact that the argument has seriously even been made that nature can be thought of as having historical agency (Steinberg 2002 and especially Foltz 2003; Drayton 2000 similarly 'makes space for the causal efficacy of the plants themselves' [Bravo 2002, 414]; Although Foltz suggests that his view was greeted with astonishment by other historians, Demeritt 1994 sees the agency view of nature as common among environmental historians, who tend to imbue nature with agency much more readily than geographers. See also Weinberg 1997 on viewing mental disorders as something non-human yet with agency). While strongly agreeing with the impetus towards uniting the causal concepts of the geographical/environmental and the social, I believe Foltz 2003 and similar arguments have it backward: Rather than non-human things being ascribed something like human intention or agency in order to unify conceptions of causation, human actions can be understood as ultimately being the result of ultra-complicated spacetime trajectories of matter, metaphysically the same (but much more complex) as non-human things (see Section 3.5.1).

[68] An objection might be that there are cases where human action changes geographic factors, making the geographic factors endogenous. Thus a more precise statement would be that geographic factors are far closer to being exogenous than most factors considered in the social sciences. Continental positions, the distribution of minerals, climate (historically), and most biogeography have been completely or virtually beyond conscious human control (and often beyond even accidental manipulation, which raises the interesting question – if the manipulation is not conscious, is it endogenous?) for most of the time period that has influenced long-term development trajectories. Furthermore, the objection that some of the factors *are* influenced by human actions (desertification, climate in recent decades) simply means that to the extent they are or become manipulated by human actions, they are simply treated to a degree as endogenous, that is, as all other factors regularly dealt with in the social sciences.

in spatial explanations grounding theoretical processes to the real-world. The use of the word contingency conflates the exogeneity arising from agency and that arising from geographic factors as well as elides the fact that spatially privileged independent variables are being invoked to explain the real-world distribution of something.

The second class of contingency, geographic or environmental influence, can be found in numerous arguments related to the location of development, the 'Rise of the West', why the Commercial and Industrial Revolutions occurred in Northwest Europe, 'Third World' poverty, and so on. For example, Jack Goldstone argues that there is a growing consensus that the movement towards a modern industrial economy in Great Britain was 'chiefly the result of a contingent and conjunctural pattern of events' (Goldstone 2002, 332). The influential work of comparative history on China and Europe by Kenneth Pomeranz is full of references to 'the fortunate location of coal', 'geographic good luck', 'geographic accidents', 'crucial accidents of geography and juxtaposition', and 'massive windfalls' (Pomeranz, flap text, 12, 16, 68, 241).[69] Concerning the different development outcomes between China and Europe, P.H.H. Vries states: 'I think there is an element of historical contingency—or better geographical contingency—that really mattered' (Vries 2001, 439). Abu Lughod (1989) argues there were similar historical conditions in Europe and China, and a critic observes: '…how then does Abu Lughod explain these areas' subsequent divergence? Contingency and circumstance' (Lieberman 1993, 548). Comparing industrialization in China and Europe, Wong argues:

> But only the initially contingent fit between the institutions of capitalism and the technologies of industrialization made possible the pattern of economic change that unfolded in nineteenth century Europe, a pattern that broke free of the world of limited material growth analyzed by the classical economists. If we accept these contingencies, we can also accept more easily the prior presence of similar dynamics of economic expansion which on their own could not drive either the Chinese or European economies into a world of vastly greater material wealth. This argument about economic change suggests that the presence in China of some dynamics of expansion similar to those in Europe makes likely a set of

[69] This is also noted by Vries (2001, 436).

contingent rather than causal connections between commercial development and industrial breakthroughs (Wong 1997, 279).

The association of location, development and contingency (or contingent 'conjunctures'[70]) is not unique to historians. Eliot Hurst argues that 'what geographers term "spatial" or "areal differentiations" is an active *process*, the pattern of which is specific to particular conjunctures' (Eliot Hurst 1985, 82, emphasis in the original).[71] Scott and Angel write 'The seeds of many of these growth sectors seem to have been planted at particular locations in what amounts to a set of highly contingent circumstances' (Scott and Angel 1987, 878).[72] In their defense of regional geography, Johnston, Hauer and Hoekveld (1990, 1-8) use the word contingency seven times in eight pages; the word appears 29 times in the short section discussing the meeting of the abstract and general with the real and local, 'The Difference that Space Makes', in Duncan and Goodwin (1988, 46-61). All of these examples of the use of the words 'contingency' and 'conjuncture' at crucial junctures of their arguments by economists, historians, geographers and other social scientists, seem to rely on the concept of contingency precisely to avoid unambiguously stating there is some causal link between geography and society, circumventing any explicitly stated link between determinism and geographic influence despite these being implied in their argument.[73]

5.4 The Proper Place of Geographic Factors: An Example Concerning Colonial Development

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[70] See Chapter 3 for a discussion of the relationship of the concept of 'conjuncture' with that of contingency, and the significance of this relationship for causal interpretation and the concept of determinism.

[71] Again note the conventional wisdom of the importance of process.

[72] Scott also describes the legacy of the work associated with Massey, especially in Britain in the 1980s: 'On the one hand, localities were seen as being subject to wider national and international capitalist forces; on the other hand, these forces were also seen as being channeled through complex local contingencies' (Scott 2000, 491).

[73] Describing a social outcome resulting from geographic factors as 'contingent' is seen as meaning it is *not* environmental determinism in these and other works; e.g., 'In Mauss's account [of seasonal and climatic effects on Inuit social organization], because social morphology is expressed as a set of seasonally differentiated effects, they should be understood as evidence of contingency and not determinism' (Bravo, 2006, 43).

The preface to Chapter 5 raises one of the most serious concerns with explaining aspects of society relying on geographic factors – that monocausal explanations based on geographic factors cannot possibly have all the explanatory power attributed to them when social outcomes are so complex.

However geographic factors are not proposed here to have direct one-to-one relations to the complex patterns of development today. By way of illustration, consider Acemoglu, Johnson and Robinson (2001; see also Acemoglu, Johnson and Robinson 2003), which argues that patterns of disease causing high mortality rates among colonialists led to the creation of 'extractive regimes'. In areas where colonialists could not settle in large numbers because of high mortality rates, they instead established an elite whose function was to extract as much wealth as possible for the colonizing power. The elite formed and maintained institutions useful for economic extraction and exploitation, and for concentration of power among the elite. When these areas of high settler mortality gained independence, local elites took power, yet they maintained underlying institutional structures which have not been conducive to development in the long-term.

Thus, in this argument, geographic factors (in this case biogeography) did not directly cause poverty, yet early effects of biogeography had long-term spatial effects that are still felt today through the mechanism of inherited poorly functioning and corrupt institutional frameworks; this condition has in turn been perpetuated by the stark difference in wealth and power between elites and the rest of society. Development economist Jeffrey Sachs has termed these types of path dependent effects 'amplifiers' (Sachs 2000). What is important is to note that these are generally not simplistic arguments based on direct effects of geographic factors. This is what sets this literature apart from earlier considerations of geographic factors rightly rejected for simplistic causal mechanisms.

Critically, however, what this work hopes to show is not simply that geographic factors *can* be considered in more sophisticated ways, although this is a relevant point. What it is hoped can be shown here is that it has not been sufficiently theorized *why* geographic factors are especially salient for understanding uneven development. It is argued that the almost exclusive focus on social *processes* and hence what are ultimately endogenous factors has been harmful to the understanding of the real-world *location* of processes, and that the reason for this is that *the study of real-world location is a question fundamentally different from all others asked in the social*

sciences because there must *be some exogenous spatially privileged independent factor invoked to explain where processes occur in the world.*

As example, consider the theory in Acemoglu, Johnson and Robinson (2001) again. It was offered as an example of how more recent theories utilizing geographic factors are more subtle than in the past. What is crucial for the argument here, however, is the precise *role* the geographic factor plays in their framework. The processes that are important to the theory are extremely complex - the global demand for sugar, tobacco, and cotton, political processes that drove European colonization, and so on. Yet regardless of the complexities of these, what is inherently spatial, what explains the *spatial distribution* of these processes - as opposed to attempting to explain the processes themselves - is the real spatial distribution of a geographic/environmental factor, such as the biogeography of malaria. It is argued that this is virtually *always* the case;[74] there is always a 'spatially privileged independent variable' that can be related to the spatial pattern of any given process, although sometimes this fact is obscured by 'amplifications'. Most importantly for reconceptualizing geographic factors and concerns about determinism in social processes, *these need not be otherwise strongly causally linked in arguments about the related social process.*

When geographic factors are considered at all, it is precisely the over-emphasis on them as strongly and directly causal in the operation of social processes that has led to their rejection. For example, Blaut writes: 'Environmental determinism…is the practice of falsely claiming that the natural environment explains some fact of human life when the real causes, the important causes, are cultural, not environmental' (Blaut 2000, 149). However, we need not strongly implicate geographic factors *in* a social process, while still being aware of the role they play in the *distribution* of that process. Malaria in no way caused the processes of European expansion, global demand for tropical products, the shipping and organizational technology that developed and so on. Yet without considering the real-world spatial pattern of malaria one could study European politics and economies, global demand for tropical products, shipping and organizational technologies and so on endlessly in attempting to understanding uneven development, which indeed has been done, yet *never*

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[74] More specifically, that this is always the case except where the other type of contingency noted before is explanatory.

understand the reason for the real-world *spatial* pattern these complex social processes assumed - the *unevenness* of development as opposed to 'uneven development'. On close consideration, this is the situation with every social process related to development, at both large and small scales. For this reason it is useful to decouple *processual* causality from *spatial* influence, disentangling the complex processual arguments from what are often fairly direct and understandable spatial influences of antecedent and initial conditions. Showing how this can be accomplished with a better understanding of the importance of initial conditions as exogenous factors in spatial explanation is the central goal of this dissertation. Section 5.6 will consider as a group examples where the location or distribution of some aspects of society have been anchored to real world locations and the significance of these for a more general understanding of spatial explanation. First, however, although parts of Chapter 1, Chapter 4 and this chapter provide examples of views on geographic influence among geographers, we should briefly further consider views on geographic factors in other areas that often consider the problem of uneven development such as history, economics, and commercial and regional geography.

5.5 Geographic and Environmental Factors in Economics and History

5.5.1 History

Among historians there is increasing attention to the role geographic factors have played in shaping historical development outcomes. Over a decade ago the historian Donald Worster made an elegant plea for the development of an 'agroecological perspective in history' (Worster 1990).[75] More recently, historian Felipe Fernández-Armesto editorialized:

> To comprehend our history, we need to study it in the contexts from which it is truly inseparable: the climates that surround it, the soils and seas on which it happens, and the other life forms on which we depend or with which we compete….Insights from ecology are revolutionising the way we look at our past,

[75] Demeritt (1994) discusses differences in outlooks on human-nature interaction between environmental historians and geographers.

> making historians aware, for instance, of how the cycles of global warming and cooling, the fluctuations of regional weather systems and the "oscillation" of currents have influenced migrations, wars, famines, gluts and the fates of civilizations….History has to be about climate because, although climate determines nothing, it conditions everything. It has to be about winds and currents because, throughout the age of sail—that is, for almost the whole of recorded history, they channeled and funneled long-range communications...Environmental science should inform economic history because all the resources we exploit, exchange or exhaust are wrested from the Earth and the atmosphere… (Fernández-Armesto 2003, 20-21).

Geography is important in the work of the 'two universally admired macrohistorians' McNeill and Braudel (Stokes 2001), and the *Annales* school more generally, as well as the work of historians Philip Curtin and Alfred Crosby. Overall, though, attention to geography among historians is very much the work of a minority and a geographic view of history has more often been held in low esteem. Genovese and Hochberg speak of 'the long and debilitating separation of geography from history and, more broadly, the social sciences' with any attempt to overcome this separation facing 'what promises to be a long struggle for reintegration' (Genovese and Hochberg 1989, vii.; relatedly, Stokes 2001 notes the low esteem in which much of the 'macro' history that incorporates geographic factors is frequently held).

One might reasonably expect 'historical geography' to have played an important role in the understanding of the place of geographic factors in history and different development outcomes, but in fact the discipline of geography has had remarkably little relevance to this area; Stoddart laments:

> We no longer ask these questions: but the questions remain. It is largely people other than geographers who are asking—and answering—them now. It is astonishing that it is Ladurie and the *Annales* school who have commandeered the whole field of the relations of climate and history. Braudel writes what is in effect geography (though without maps) and calls it history: the historical geographers tag along in dutiful homage. One could multiply examples endlessly (Stoddart 1987, 334).

Harvey long ago noted that 'An unfortunate gap has developed between the scholarly studies of the specialist historical geographers, who frequently appear to think that the importance of their subject suddenly declines after 1800, and the analytical techniques of human geographers concerned with contemporary distributions' (Harvey 1967, 550). A survey of recent editions of *The Journal of Historical Geography* and *Historical Geography*, while showing many changes in topic and point of view since then, confirm that the influence of geographic factors in history is still not a central (nor even minor) concern.

5.5.2 Economics

As noted in Chapter 1, in economics the failure of one type of development policy after another as chronicled by the long-time World Bank economist William Easterly in *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics* (2001), as well as by Stiglitz (2000), Black (2002) and by others has led to a particularly strong bout of 'casting about' for *any* useful theories or factors. It is likely no accident that economists with the most hands-on experience with development policy failures at the World Bank and related organizations have been among the leaders in pragmatically reconsidering the old but rejected idea of geographic and environmental influence. This was the case with an early isolated work in this area, *The Tropics and Economic Development*, by the then director of the Economic Development Institute of the World Bank, Andrew Kamarck (1976),[76] and continues in the work of Easterly and Levine (2003) and Sachs and his colleagues at the Harvard Center for International Development (Warner and Sachs 1995; Bloom and Sachs 1998; Gallup 1998, Gallup and Sachs 1998; Mellinger, Sachs and Gallup 1999; Gallup Sachs and Mellinger 1998; Masters and McMillan 2001; McArthur and Sachs 2001; Rappaport and Sachs 2001).[77]

A related strand of economic literature stems from an influential paper that made claims for environmental influence in the uneven development of the Americas

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[76] The emphasis on geographic factors as causal compelled Kamarck to subtitle his work '*A Provocative Inquiry into the Poverty of Nations*'.

[77] Geographer David Harvey (2001, 228) mentions the World Bank conference on links between geography and development titled 'Is Geography Destiny?' with the implication that geographers will be amazed this could take place. (See also Gallup et. al. 2003, *Is Geography Destiny?*)

(Engerman and Sokoloff 1994). Building on this and other historical arguments, Acemoglu, Johnson and Robinson have written a series of papers (2001, 2002, 2005) theorizing the role of institutions in economic development, with their findings potentially supporting the view that the spatial pattern of these institutions was shaped by geographic factors. They conclude:

> Finally, though this is not our view, the relative economic success and expansion of a number of European countries from 1500 may have resulted from Europe's geography. So income differences today, say between South and North America, may reflect not their geographic differences, but indirectly the geographic advantage that Europe enjoyed relative to the rest of the world. Whether the world's geography has played a major role in shaping economic development over the past millennium is an area for future research (Acemoglu, Johnson and Robinson 2002, 35).

In subsequent work (2005) they even change their view, arguing that this is indeed the case, with European development (and subsequently, European colonies and global patterns of development) being deeply influenced by geography.

Geographer Neil Smith writes in *Uneven Development* (1984) that theories based on geographic variation are not able to explain the full extent of variation in development, and 'In the end, such explanations of the concentration and centralization of economic activity are only half-truths' (Smith 1984, 103). While only a figure of speech, the idea that these explanations might account for even half of the variation in development is important. Robert Solow, Nobel Laureate in economics, asks the same question as Smith: 'The more basic question is: why is the composition of economic activity not uniform over the face of the earth? Why is there specialization or geographical division of labor at all?' (Solow 2000). Like Smith he states the common idea that in part this is due to 'increasing returns to scale and path dependency from historical happenstance'. But first he recognizes the importance of the 'half truths' Smith noted on the variation in development, that the first 'obvious reason is local variation in climate, terrain, transportation possibilities, the availability of natural resources, and so on' (Solow 2000; note the similarities in these discussions and the introduction to Hoover 1948, *The Location of Economic Activity*). Tracing the processes through which early geographic differences were amplified into the present

wide divergence in development is an important aspect of understanding current development differences; since Smith's writing there is a heightened appreciation of the path dependent nature of development (in a return to the earlier views of Myrdal and Hirschman). But crucially, and often overlooked, this amplification process *increases* rather than decreases the importance of following up on these earlier ideas of geographic and environmental differences as the *seeds* of much larger later differences, the source of the original spatial variation and patterns that later were amplified by other processes.

5.5.3 A Note on regional and commercial geography

The idea of considering geographic factors as causal in location and distribution was central to commercial geography and an important aspect of many regional geographies. A potential criticism with the current work is that there is nothing new in these geographic approaches to development. However, both commercial and regional geography were limited in their approaches in important ways, and both significantly diminished in importance starting from the 1960s to the present.

Neil Smith (1984) notes (similar to points made in Stoddart 1987 and Turner 1997) that mainstream geography, especially at the university level, largely discarded consideration of geographic factors in explaining spatial outcomes. Overall, giving up the goal of spatial explanation (which if our larger argument is correct was inevitable once geographic factors as causal are given up), meant that the goal of spatial explanation central to commercial and (some) regional geography was also lost. Smith writes:

> Today's geographers no longer have such confidence in the world-historic importance of their discipline, or in its destiny. Just as commercial geography and Mackinder's kind of political geography were means of understanding and promoting the rise of empire, so their fate followed the fate of empire. The demise of the British empire brought about the demise of this geography. The commercial and regional geography referred to above no longer occupies a central place in the discipline (Smith 1984, 103).

As Smith notes, regional as well as commercial geography concerned with the effects of geographic factors on uneven development fell from favor in geography.

Exceptional regional geographers continued to consider geographic factors, such as R.A. Donkin and Donald Meinig. Meinig especially is a respected regional geographer who has worked to explain the real-world patterns and distribution of the populations and political borders of a number of regions (Mormon, Texas, the United States), often considering geographic factors as causal in location/distribution outcomes. However, considering the long span of geography since the decline of regional geography to the 1990s, Meinig states his view (of at least American) geography in the 1950s:

> I was convinced that professional geography in America badly needed [the geographical approach to history and the historical approach to regional study]. Human geography and regional geography were too largely textbook in form, stereotyped descriptions of a set of standard topics with rarely any historical or interpretive dimension at all. Certainly no geography book told me what I most wanted to know about my country (Meinig 1992).

Not only did the geography of the 1950s not answer many of the causal/distribution questions Meinig focuses on in his own work:

> I thought my approach was a valuable way of looking at a region. It answered most of the questions I had at the time, and I hoped it might encourage others to do something similar on other regions…In this…I seem to have overestimated that prospect (Meinig 1992).

Overall, commercial geography became almost entirely deductive and quantitative, and lost sight of the goal of seeking empirically grounded explanations for the location of real-world phenomena. Regional work in the nature of Meinig, full of discussions of geographical influences on migration, culture, political borders and so on, was promising yet as Meinig says, rare. Reviewing a later work by Meinig, Baker says that it 'constitutes a sustained endeavor to secure a marriage of theoretical and empirical approaches of the kind which has for long now been recognized as being both desirable and necessary for work in both historical and contemporary human geography, but which is still all-too-rarely achieved' (Baker 1995, 370). Much of the promise regional geography had for explanation of location and distribution was simply not realized. Hart writes that 'the number [of American geographers] who

have actually written any kind of regional geography, apart from standard undergraduate textbooks, is astonishingly small, and the quality of much of what has been written is astonishingly bad' (Hart 1982, 17). Reviewing other regional work from other countries, such as in Johnston, Hauer, and Hoekveld 1990, suggests that explanation of location and distribution in the manner considered here has not been a priority elsewhere either (see also the brief overviews of German and French economic geography in Glückler and Bathelt 2003 and Benko 2002 respectively).

5.6 Considering Explanations of Location/Distribution as a Group - Examples

> Geographers, like the mythical giant Anteus, derive their strength from contact with the earth
>
> Hart 1982, 24

As mentioned in Section 5.3, it is useful to consider as a class in themselves all examples in which social scientists have attempted concrete explanations of why a process is located or distributed where it is. By doing so, a surprisingly small number of factors are found to be recurrent. While no panacea, systematizing what these factors are and how they have been used is a useful step towards a more complete understanding of how to explain real-world development patterns. A systematic review of attempts to explain the real-world location of social processes (including the formation of industrial clusters, agglomerations, cities, trade routes and similar) shows that there are small number of factors that recur over and over again, and that these are almost always (as initial or antecedent conditions or 'context') geographical/environmental in nature.[78]

Evidence from both geographers and other social scientists is important, although for different reasons. In the latter case, because social scientists and historians do not have any disciplinary 'core' that influences them towards human/environment explanations of location, then examples from these disciplines help demonstrate that geographic factors are somehow salient in explanations of real world

[78] That is, always except when the type second type of contingency discussed above, from human actions, is the cause. Ultimately, human actions might be thought of as 'geographical' in nature; see Section 3.5.1.

location/distributions, when any factors other than geographic factors might just as well be proposed by non-geographers. In the case of geographers, as noted (Abler 1987, Fitzsimmons 1989, Kates 1987, Hanson 1999, Turner 2002a, and the quotes by Eliot Hurst and others) geographers since the 1960s have been particularly sensitive to any appearance of arguing geographic factors are causal in social outcomes; hence explanations by geographers from about the 1960s on that have geographic components are especially interesting, as they were presented *in spite of* acute awareness of their controversial nature within geography.

Migration is perhaps the most dramatic way regional cultures are formed and transformed, abruptly carrying long-term adaptation to contexts in one location to a new location (Sowell 1996). Because of its potential for dramatically altering the cultural and institutional makeup of a region, and the relative ease by which migration can be studied, it often plays a central role in causal explanations of patterns of institutions and culture (e.g., in the works of Meinig). Clearly, though, migration begs the question of the *origins* of cultural and institutional variation, a much more difficult and longer-term problem. Meinig states:

> we must ask two fundamental questions: (1) why do major cultural patterns and movements begin where they do (the problem of the 'culture hearth'), and (2) how do they spread to other peoples and areas (a problem of spatial diffusion)? (Meinig 1978, 1189)

The second of these is considered first, with longer-term cultural development considered afterwards.

The rapid spatial diffusion of cultures through migration is obviously a particularly salient factor in the 'New World' together with those parts of the 'Old World' that experienced similar human movements, such as Siberia (Russian expansion) and central and southern Africa (with the relatively rapid displacement of indigenous peoples by Bantu speakers). In these areas, migration patterns and the reasons for them are often the central explanatory factor of current cultural and institutional patterns.

The process of migration does not reduce to only geographic factors, but a great deal of the spatial realities of migration (and historically, colonization) are patterned by geographic factors that shape the incentives and constraints of the countless individuals involved in migration (or colonization). For example, the specialist in empires, Richard Drayton, recently summarizing reasons for imperial expansion, writes 'The demand for [foreign resources], and thus the lunge outwards of Vikings, or Spanish hidalgos, or Zulus, may be the expression of some new environmental pressures, population surges, agrarian crises, ages of ice or drought' (Drayton 2004, 19); the factors Drayton cites as being behind the cultural movement due to imperial expansion are all geographic in nature.

As another example of influences of geographic factors on migration, this time considering the variation in soil fertility and the settlement of the United States, two geographers write:

> Each wave of pioneers had to choose a place to settle, often without clear guidelines. Reports of successes and failures were passed on to newcomers, who used the information to help them choose their land. In time, the rationales for those choices became enshrined in regional variations of the national myth. Immigrants to New England were advised to find level and stone-free fields; those crossing the Appalachians told each other that nut trees grew on the soils that would prove best for crops; Southern planters were attracted by the dark soils of the Alabama Black Belt; migrants to central Kentucky took a decade to learn to discriminate between the Outer Bluegrass and the topographically similar but less fertile Eden Shale hills; in Michigan and Illinois, settlers discovered that treeless soils were not necessarily barren; in the Plains States, they found ways to live without a nearby woodlot; and in Wyoming, access to easily transported water proved to be more important than the texture of the soil. In time, Americans learned some basic rules about land evaluation in each part of this vast continent…Those early decisions about the quality of land were fraught with danger, because a bad choice could mean starvation (Gersmehl and Brown 1986, 480).

The single quality of soil fertility had a deep impact on where and to what extent settlement occurred in the United States. Combining the real-world pattern of soil

fertility with the different origins of settlers in different settlement waves gives the beginnings of an explanation of the spatial cultural pattern of the United States.

Another example of inadvertently anchoring a posited social process using geographic variables is by the geographer John Marshall; he seeks to give a clear example of how geographers use the scientific method for explanation in *The Future of Geography* (1985). This example is not considered in order to discuss the scientific method Marshall proposes, but rather to provide an example of how another explanation of a real-world distribution of a process (urbanization and population density in Ontario) rests on exogenous geographic factors.[79]

The causes of the population distribution in Ontario are in part due to the normal gradient of decreasing population from south to north in northern latitudes corresponding to agricultural productivity. Another key factor is the low productivity of soils on the Canadian Shield: 'Most of northern Ontario lies on the Canadian Shield, an extensive area of Precambrian rock which was largely stripped bare of soil by the action of continental ice sheets during the Pleistocene glaciations. Southern Ontario, in contrast, was a region of glacial deposition rather than erosion, and here the soils are capable of supporting prosperous farms' (Marshall 1985, 125).

By using the methods Marshall proposes, the soil and latitude combinations of Ontario accurately predict the relative populations of fifty of the fifty three administrative districts of Ontario. The three areas that do not match the prediction of the theory are a southern administrative area, Manitoulin Island, that has lower than the predicted population and two northern areas, Muskoka and the Sudbury Basin, that have higher than expected populations. Marshall's main point is to show that anomalies do not overturn theory; the three anomalies are thus explained: The relatively low population of Manitoulin Island is due, suggests Marshall, to its (transport related) isolation, the higher than expected population of Muskoka is due to its status as a resort area, and of the Sudbury Basin because it has one of the world's richest concentrations of nickel and copper and hence a large mining community. Thus the unexpectedly high population of the Sudbury Basin is directly explained by

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[79] The theory Marshall considers is that population density is a function of the number of opportunities in an area for earning a livelihood. Areas of agricultural surplus should be more densely populated and the theory 'can be further developed by noting that areas of productive farmland also support market towns, and that these same areas, being well peopled, are more likely to attract manufacturing industries than districts where population is sparse. The growth of towns and manufacturing will lead to an even higher level of population density' (Marshall 1985, 125).

the exogenous factor of the location of minerals. There are social dimensions to the anomalies of Manitoulin Island and Muskoka, such as the location of land and water transport routes, and in the case of Muskoka, the aesthetic values of society, yet these are *spatially* anchored by the exogenous geographic factors of the real-world location of the lakes and waterfalls of Muskoka and their proximity to Toronto, and the relevant land and water transport routes themselves likely have important geographic determinants as well.

Marshall has chosen a single example, thus presumably his best, to show how to answer a question about the real-world distribution of a theorized social process in Ontario, Canada. All of Marshall's factors, including those that explain anomalies, turn out to be related to real-world variation in environmental and geographic conditions.

5.6.1 The ubiquity of anchoring

Even approaches not usually associated with an emphasis on causal argumentation anchor their ideas with geographic factors to the extent they are anchored at all. For example, since immigration and soil were both considered together above, consider a 'hermeneutic' point of view taken by Peet (1997). 'The Cultural Production of Economic Forms' discusses the development of the 'New England discursive formation'. One finds that the *location* of this process is anchored by the conjuncture of immigration[80] and (a shared view of) a particular local environment that marks the boundaries of a shared, if imagined economy. Peet cites one New Englander who describes 'the rock bound region of New England' and the stories these people tell about themselves are shaped by what Peet describes as 'a glaciated land where winter lasts fiercely for five months, and intermittently for seven months of the year' (40). The process of discursive formation Peet discusses is anchored *spatially* in the conjuncture of particular immigrants in an area of a particular soil structure and climate. Even in this very different type of geography (citing Foucault, Castoriadis, Habermas, and Bourdieu), if there is any spatial anchoring at all it is based on the familiar categories of migration and local geographic factors.

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[80] In particular, the expansion of international Calvinism 'brought the Dutch to New Amsterdam (later New York), French Huguenots to New York, South Carolina and Massachusetts, Scottish Presbyterians to the Middle Colonies, and the Puritans from England through the Netherlands to New England in 1620' (Peet,1997, 40).

5.6.2 Long-term political development

A minority of political scientists, historians and historical sociologists have sought the origins of political variation in environmental variation and spatial relations. Stein Rokkan (1975) attempted to explain variation in state formation in Europe based on patterns of urbanization that were in turn shaped by geographic factors, combined with distance decay from Rome (and thus Church interests dominating political affairs on the north-south axis in part accounting for the late state formation of Italy and Germany vis-à-vis more distant areas of Europe). This research was cut short by Rokkan's early death (similarly, the promising work of the Middle Eastern historian Marshall Hodgson, mentioned in Chapter 6, was also cut short by his early death. Had they continued their work large-scale and environmental factors might have had some degree of greater influence among historians and political scientists/historical sociologists at an earlier date).

The economist Charles Kindleberger cites a number of historical accounts that support a direct link between soil, agricultural potential, and political development in Europe, and argues that more research should be undertaken into these connections. The relevance and historical breadth of his examples make an extended quote worthwhile:

> Ricardo made clear long ago that not all land is equally productive. Rich land that earned large rents to be captured by the aristocracy in whole or in part was matched at the other end of the spectrum by no-rent land that was unable to support nobility. Weber observed that in ancient Greece land in the plain accumulated in the hands of nobles, while the hillsides that could not produce a rent were everywhere held by the peasantry. Braudel made similar observations of the Mediterranean in the Middle Ages, noting that mountains made for democracy, while plains were suited to the aristocratic form of government…Differences among nobles also frequently related to the quality of the soil. The Junkers in the north and east of Germany were originally relatively poor and knew how to milk; in Bavaria, nobility did not undertake farm work. …In southern Germany—Türingerwald, South Mecklenberg and the Schwarzwald—there were no nobles because the soil was thin and a surplus could be acquired only from extensive holdings….Joseph Marshall, a British civil

> servant traveling through Germany in the eighteenth century, noted 'It is always to be remarked that the gradations of freedom are ever to be found in mountainous countries; in general such are free; but even under absolute monarchs they enjoy more liberty than the subjects of the same prince who inhabit plain countries…' …Rappard examined the topography of Switzerland with its separate cantons prior to confederation in 1848 and found democracies in the poor Alpine districts (Uri, Schwyz, Unterwald, Zug, Glaris, Appenzell), patrician aristocracies in the plains, corporative oligarchies in commercial cities, and an assortment of monarchies and aristocracies, ecclesiastical and secular, absolute and qualified in mixed cases (Kindleberger 1978, 168-169).

The study of effects of geographic factors on the location and nature of state and political formation occupies a middle ground between the very long-term 'ethnogenesis'[81] approaches resulting from collaborations of archaeologists, linguists and biologists and the short-term perspectives of the effects of cultural and institutional variation on economic performance. (Continuing this approach is part of the future work from this dissertation, the beginnings of which are attached as Appendix B, both as an example of future directions and to elaborate on ideas discussed here and in Chapter 7). Increasingly there is work relating factors intermediary between geography and social development, especially agriculture, population densities, and development.

For example, to the degree that population density is considered to be related to factors such as agricultural productivity (Pounds and Roome 1971; Luck 2007) and other geographic factors (Small and Cohen 2004) and transport costs (Appendix B), studies that show patterns of population density to be related to institutional and economic outcomes suggest spatial influence on social outcomes from geographic factors. High population levels have been associated with technological invention (Kremer 1993; Klasen and Thorsten 2006; Algaze 2005 even associates population density and the development of increasing returns industries and institutional development in *ancient* societies). Goldstone 1992 associates patterns of Eurasian population change with waves of Eurasian revolutions and political development.

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[81] This term is associated with the controversial work of Lev Gumilev, influential in anthropological studies throughout the ex-Soviet region (see Wagner 1991; Shnirelman and Panarin 2001), which of course constitutes a great deal of the Old World of special interest for long-term cultural development; the term is useful and transcends his work.

Gregory Clark 2007 also offers a new (and controversial) view on the relation of population and why the industrial revolution happened in England. Regions of historically high population densities are associated with *less* income inequality today, (Sylwester 2003, perhaps because institutions related to dealing with large populations were conducive to the development of 'good' institutions. Areas with high levels of trade experienced the demographic transition earlier and differently than areas with low levels of trade, with the effect of strongly amplifying the development differences between areas of high and low industrialization and locking very high population areas into unskilled labor-intensive industries (Galor and Mountford 2008). (The interplay between agricultural productivity and transport costs is especially subtle but central to patterns of urbanization - literally the 'civilization' so central to institutional development. Appendix B expands on this relationship; also see Bairoch 1988 and van der Woude, Hayami, and De Vries 1990).

5.6.3 Summary

In the above explanations of the distribution of some social process, with examples from an article on physical geography (Gersmehl and Brown 1986), a volume on the nature of the discipline of geography (Marshall 1985), and another (Peet 1997) from an alternative perspective within geography, as well as others by economists, historians, political scientists, anthropologists, archaeologists, linguists, and historical sociologists, a small number of geographical factors such as agricultural productivity, transport costs and other forces that caused or shaped migration patterns are found to be explanatory. It is important to note that this list has not been selectively made. Most social scientists do not try to explain real-world locations at all, and thus there are relatively few examples within the social sciences where explanation of real-world location/distribution is even attempted. Time after time, when these were found, they relied on the geographic factors listed above or other similar factors. This pattern was at first noticed inductively through reading explanations of location. Subsequently, attempts to explain location/distribution were actively sought out; these were found to confirm what was previously expected inductively. These examples are representative of those that anchor a social process to real-world location, although more common is simply ignoring the problem of anchoring processes to the real world and thus avoiding geographic factors entirely.

5.6.4 A Note on 'new regionalism'/'cultural economy' and regional variation

Within geography various related approaches - 'new regionalism' and 'institutional geography' (Amin 1999) and more recently 'cultural economy' (see Amin and Thrift 2003 for examples and an overview) - have been popular in recent years in the study of regional variation. Similar to and in part developing from the intensive work of the 'CURS project' (Changing Urban and Regional Systems) and work associated with Doreen Massey and the 'localities project' in the 1980s (Massey 1978, 1979, Cox 1992) cultural economy and new regionalist approaches are based on largely qualitative, intensive methods (that is, focused on small regions rather than extensive or international comparisons), where institutional or cultural differences between regions are studied to understand how these lead to different regional outcomes. Like the intensive work associated with Doreen Massey and the 'localities project' the detailed nature of cultural economy might give the impression that real world location/distributions are being explained. However, although this research may usefully show in greater detail mechanisms of micro-macro interactions (micro-macro integration has likewise been considered a major yet unachieved goal among economists), these type of studies explain spatial distributions of socioeconomic factors through reliance on the distributions of other endogenous factors, cultural and institutional factors, and thus do not truly resolve the problem of circular endogeneity.

An example is the study of the regional economy of Salt Lake City in James (2003), a good representative of the cultural economy approach to regional development differences. Like Saxenian (1994) and Gertler (1997), James shows ways culture affects a regional economy, in this case Mormon culture vis-à-vis business practice and innovation in Salt Lake City. He demonstrates that in the context of the existing high tech cluster in Salt Lake City there is a set of shared social practices, norms and values that cause the Salt Lake City cluster to perform differently than other high tech clusters, and more importantly, in detail how mechanisms of cause and effect operate.

James (2003) shows that in part the wider pattern of regional economic performance in the western United States is shaped in one area by an underlying set of pluralistic social practices, shared norms, and values; it goes a long way towards clarifying how, precisely, these shape that area. But the area itself, the reason for the underlying *spatial* pattern of pluralistic sets of social practices and shared norms and

values, is not addressed at all. As such this does not, nor is meant to, explain the spatial variation in the wider regional economy. However, problems arise when these type of explanations are thought of, because of their ever greater detail, as somehow resolving the problem of circular endogeneity.

While no explanation can ever be complete, an understanding of the spatial pattern of regional variation would likely include consideration of factors related to the development of Mormon ideals, and since these did not occur in the Salt Lake City area, then the factors in the region where they did develop. Also important is an understanding of the cultures of the points of origin of immigrants to Salt Lake City, and the early opportunities and restraints of endowments on development in Salt Lake City. Key considerations would likely include both the origin of sets of social practices and reasons for the growth of particular kinds of industries in certain areas. Where migration has been central to the formation of the existing population in a region, reasons for this migration are also a factor, and the cultural characteristics of the region must at least to some degree be sought in the culture of the point of origin of the immigrants (Olson 1996, Sowell 1996, 1998).[82]

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[82] For example, the origins of Mormon culture are in some sense understandable, with roots in a specific set of circumstances that led not just to Mormonism but to an unusually high number of new religions and political movements, some similar to Mormons, including in details such as polygamy. Consider that in the same region of New York and time period that saw the development of Mormon ideas (this account of western New York State is adapted from Lane [2003] and related World Book [1997] articles):

- the prophet Handsome Lake led the Seneca to found a renewed version of the traditional Longhouse religion
- radical Shaker communities flourished in the region
- a visionary 'Quakerism' of 'Universal Friends' was founded in Penn Yan, New York
- 'New Age' religion in the United States (and the popular idea of the 'séance') traces its roots to the followers of the Fox sisters in Rochester; to this day one of the world's largest 'Spiritualist Communities' is in Lilydale, near Rochester
- The Chautauqua Methodist revivals became renowned throughout the region (and to this day)
- The Oneida Community flourished from 1848, including the practice of 'complex marriage', a form of polygamy
- Frederick Douglass, a former slave instrumental in the abolition of slavery and black rights, wrote and distributed his (radical for its time) newspaper, *The North Star* in Rochester
- the Underground Railroad stopped in Seneca Falls, where the first Women's Rights Convention was also held and Elizabeth Cady Stanton and Susan B. Anthony founded the American suffragist and feminism movements.

It is hard to imagine that this high spatial concentration of radical social and religious ideas was entirely random. There seems to have been something in this particular region and time period promoting rapid change, often thought to be related to the construction and opening of the Erie canal and the rapid social and economic change it entailed.

Just as the roots of Mormonism seem to be part of a larger pattern and exceptional circumstances, so too the roots of industry in Salt Lake City. Early on copper mining and a chemical industry were important; the area still has the largest open-pit copper mine in North America in nearby Bingham

5.7 Discussion

5.7.1 Long-term context and human ecology

Especially relevant to the Old World, where rapid migration similar to that in the New World has been less important, is the very longest-term development of cultural and institutional variation (what Meinig, above, calls the problem of the 'cultural hearth'). Considering the millennia of close interaction of humans and environment, logically this should be a question dominated by geographers. Hartshorne wrote:

> In no small part, the ultimate goal of geography is to provide scientific description of the way in which the originally unorganized areas of the earth are organized into various kinds of functioning regions (Hartshorne 1960, 53).

Similarly, on the evolution of social variation, Sauer states that 'One of the fundamental questions in all social study is how to account for the rise and loss of institutions and civilizations' (Sauer 1940). Sauer clearly saw variation in social organization as resulting from variation in the natural environment:

> The culture area, as a community with a way of living, is therefore a growth on a particular 'soil' or home, an historical and geographical expression. Its mode of living, economy, or *Wirtschaft*, is its way of maximizing the satisfactions it seeks

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Canyon which saw large scale mining from 1906 (growing quickly in the first world war) and Great Salt Lake itself was and still is 'mined' for chlorides, magnesium, and potash, and is responsible for the early and ongoing chemical industry in the area. These in turn are largely what led to the military investment in the area in the Second World War and subsequent military investment similar to that which has been crucial to the Los Angeles, San Diego, San Francisco Bay, and Boston area high tech clusters.

The development of Salt Lake City's current sets of social practices, values and norms also lies in Northwest Europe and the conditions conducive to the emigration of the Germans, English, Danes, Norwegians, Swedes, Scots and Welsh that came to make up a large part of the Utah Mormon community and the shared values and norms of Utah. The geographically focused, non-random process continues with the Tongans, Samoans, Guamanians, Fijians, and Tahitians that have more recently emigrated to Utah – what are the conditions that have led to acceptance of Mormonism in Polynesia, their emigration, and what effects will this new group have on Mormon culture? (*The Salt Lake Tribune.* 2000. 'The Polynesians of Utah: Islanders' dreams meet cold reality in Utah'. June 12). The point is, all of these social processes, although themselves extremely complex, are spatially anchored to real world locations and distributions by relatively straightforward linkages to geographical factors.

> and of minimizing the efforts it expends. That is perhaps what adaptation to environment means (Sauer 1940).[83]

Decades later, the economic historian Douglass North expressed a similar view, that ideological differences 'emerged primarily from the diverse geographic experiences of groups contending with their environments and evolved into different languages, religions, customs, and traditions' (1982, 209).

However, since Sauer's address, there has been an almost complete withdrawal from these questions by geographers. The political economist Samir Amin (1976, 10) 'dismissed geography as having failed to answer its basic problematic—the relationship between the social formation and its natural environment' (in Salih 1984, 79). This dissertation works from the perspective that these questions concerning the long-term development of society should properly be in the realm of geography as much or more than any other discipline, and that reclaiming this area of study, in addition to human impacts *on* the environment, is one way of further uniting geography around a central human-land theme as well as improving its academic status and visibility to the public.[84]

More recently, scholars have noted logical problems resulting from inattention to long-term cultural and institutional development. Gertler observes that 'proponents of [social and cultural arguments] have adopted a surprisingly unsophisticated

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[83] For geographers, especially, who are widely taught that Sauer was the epitome of the anti-environmental influence movement this statement may be surprising. What else is adaptation *to* the environment but influence *from* it? It is also interesting the way in which Sauer's language suggests individual choices based on individual incentives and constraints are, cumulatively, the cause behind social adaptation, language similar to both modern evolutionary and economistic approaches to the study of society.

[84] In a commentary in *Geoforum* B.L. Turner asks 'If geographers find simplistic the spatial claims of Krugman (1997) and Sachs (e.g. Gallup and Sachs 1999) or the human-environment notions of Landes (1999) and Diamond (1997), we might wish to pause and reflect on at least two questions. Why does geography repeatedly abdicate powerful ideas developed or nurtured within its ranks, abandoning them for rediscovery and reinvention by other fields of inquiry? Why are these reinventions, despite our labeling them simplistic and even erroneous, taken seriously by the academy and public at large…?' (Turner 2002b, 428). Reviewing Diamond (2005) Ron Johnston similarly observes that 'As a late interloper he has stolen our ground, presenting a wide audience with the sort of book that we are forever bemoaning that geographers should but do not write…He is getting geography a public profile for us' (Johnston 2007, 410). We would argue that the inherently satisfying nature of explanations that break the circularity of explanations based solely on aspatial and endogenous factors is precisely the reason Diamond's work (especially 1997) has been so well received by non-geographers. Geographers such as Blaut (2000), Sluyter (2003) and Merrett (2003) may disagree with the details of Diamond's arguments; the best way to counter them, however, would be to similarly integrate exogenous geographical factors into counterarguments, rather than banish geographic factors altogether.

understanding of how culture is formed and changes over time' (Gertler 1997, 51) and cites Sayer and Walker (1992) that 'culture is often misrepresented as something ethereal and eternal, divorced from historical material practice' (178). Perhaps Gertler comes closest to voicing the concern that if spatial (regional, national) variation in culture or institutions is used to 'explain' spatial variation (regional differences) in economic outcomes, then a full explanation also entails an understanding of the origins of the variation in culture itself: It is 'important to consider the provenance of the very institutions which we have implicated as having so much power to shape corporate and regional practices….[and] not to treat institutions as if they were "carved in stone" or inherited from on high' (Gertler 1997, 57)[85] [86]

However, the work that is illuminating the long-term origins of patterns of cultural variation has largely been (because of its extreme complexity) a multidisciplinary collaboration of archaeologists, historical sociologists, linguists, and anthropologists, with promising collaborations between biologists and linguists in mapping genes and languages. Examples of the latter include Barbujani and Bertorelle (2001) tracing the origins of European cultural variation, Bamshad, Kivisild, Watkins et. al., (2001) tracing the ancient ethnic roots of Indian castes, or Gresham, Morar, Underhill et. al. (2001) on the origins and spread of the Roma. Rogers et. el. (1991) trace the origins of linguistic variation in native North Americans to the biogeographic variation caused by Ice Age refugia of flora and fauna. These collaborations, many of which unashamedly cite geographic factors as causal in their explanations of geographic distributions, are shedding light on the very longest-term origins of social variation. Eventually, tying the discoveries of these research areas with the cultural and

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[85] and 'while it is important to assert that cultural characteristics are much more than 'mere epiphenomenona,' it is also important to examine the process by which cultures are actively produced and reproduced by social practices and institutions over time' (Gertler 1997, 51). A critical difference here from Gertler, however, is that Gertler views institutions as created and changing significantly in the short term ('produced and reproduced'). Yet it is precisely this view that has been called into question by studies that show the resilience of social and institutional patterns over the very long-term (e.g., Sowell 1996, 1998).

[86] Cultural economy arguments on culture and institutions sometimes seem to argue that culture causes institutions, other times that institutions cause culture. Gertler says 'I have endeavoured to show how traits and attitudes we commonly understand as being part and parcel of inherited cultures are themselves produced and reproduced over time by day-to day practices that are strongly conditioned by surrounding social institutions and regulatory regimes' (Gertler 1997, 55). This is surely true, but still does not explain the spatial variation of social institutions and regulatory regimes. The process of influence between culture and institutions seems 'autocatalytic', with both affecting each other from the very origins of both, and thus inseparable. The only way to account for the *spatial* variation in these seems to demand at *some* point spatially varying exogenous factors.

institutional variation at the root of many economic and geographic theories promises a fuller causal understanding than we currently have. While beyond the scope of the present work, consideration of these possibilities is increasingly realizable and a promising direction for future research.

5.7.2 Some final thoughts on geographical factors in explanation, ethics, and society

Chapter 4 discussed ethical concerns with determinism, and many of these are expressed by geographers with geographic determinism in particular in mind. The aversion to suggesting geographic factors are causal in human affairs is deeply embedded in social scientific thought. However, it may be that it is precisely the *absence* of geographic factors in the analysis of development outcomes that has allowed for many of the morally suspect ideas concerning development to linger.

Ignoring geography means imagining a uniform world with no differentiation in physical characteristics (this is usually implicit in the aspatial work of much social science). It is hard to imagine by what mechanism socioeconomic and cultural variation would arise in this uniform world. In such a world, for the millennia that humans have been organizing socially and developing culturally, there would be little reason for trade, as there would be no difference in access to or types of resources, little reason to migrate or travel, as everywhere would be the same, little reason to adapt or innovate any differently than one's neighboring communities. This is the world implicitly assumed when geography is ignored.

However, in one way or another social scientists and historians fall back on social differentiation to explain variations in economic and political organization. Explanations of differential economic productivity often have at their root the idea that either:

1. there is some deficiency in the culture, such as low 'social capital' or 'amoral familism',[87] or a religion that fails to foster a work ethic, or a lack of institutions that internalize externalities and create incentives or
2. the culture is the victim of oppression or exploitation.

[87] This refers to Edward Banfield's groundbreaking 1958 study, often seen as the beginning of the modern social capital literature.

These two basic ideas cover the spectrum of right ('It's their fault') and left (dependency theories, postcolonialism). Hybrid theories can also be constructed, such as blaming a lack of institutions or social capital on some earlier period of oppression and exploitation (e.g. Putnam 1993). Nevertheless, all of these ultimately rely on social and cultural variation as reasons for political and economic variation, although this is not always explicit. That culture is the basis is clear in (1) above. That oppression and exploitation in (2) are also social explanations is perhaps less obvious. Yet otherwise, how did the oppressing and exploiting society become wealthy or powerful enough to oppress and exploit in the first place? The only answer is that their society varied from others in some aspect of political, military or economic organization. Again, it is difficult to imagine how these organizational differences arose in a world without variation of geographic factors.

Contrast the right and left types of explanation with explanations of variation that ultimately lie in geography. Because geographical arguments ultimately do not rely on social differences, as no one is to blame for geography and very long-term processes, they do not readily fit into the framework of political ideologies and, except perhaps in their crudest forms, do not easily serve political ends. Rather, when the complexities of the amplification of early geographic differences into later social patterns are diligently traced they more often undermine the arguments of both left and right because they have as ultimate causes neither culture, nor oppression and exploitation. The inherently apolitical nature of geographical explanations has brought them scorn from many political sides and likely contributes to their absence in much modern political and economic literature. Rather than geographic determinism, it is subtle 'uniform world' assumptions themselves that make a left-right dichotomy in the debate on economic and political performance logical.

Yet the world is not marked by uniformity. Stemming from still earlier uneven antecedent and initial conditions, the world shows extreme variation in every aspect of its climate, altitudes, length of days, angle of sunlight (affecting photosynthesis rates), mineral deposits, soil types, wind currents, ocean currents, ocean temperatures, ocean salinity, seismic activity, access to navigable water, access to fresh water (for irrigation), rainfall intensity, rainfall regularity, which all further lead to variation in flora, fauna, different population densities, disease patterns, urbanization patterns and the location and activity of cities, trade patterns, migration patterns (including human

migrations in the past and to some extent today) and many, many other variables, shaping incentives and constraints on millions of individual decisions over millennia.

Far from being unethical, observations of different organizational responses to highly varied environments clearly demonstrate the genius of *all* human cultures in adapting to limits imposed by geography and seizing unique opportunities presented by geography. Ignoring these factors ensures that political and development theories remain incapable of fully explaining the inequity of global wealth distribution. More dangerous still, it further ensures that evidence needed to refute simplistic cultural and racial ideas of unequal political and economic performance are not developed, paradoxically leaving room for those who would blame cultures themselves.

In this time of heightened concern for the environment, it may also be wise to reflect on the ethical-ecological implications of the belief that humans have not been influenced by nature. Geography is in this sense an inherently ecologically oriented and philosophical enterprise. 'Geography has sometimes been represented as a kind of moral philosophy, primarily in the sense that those who have a deep fascination for the earth needs must have a special concern for the care of the earth.' (Meinig 1992, para. 40).

Understanding the human impact on the environment has become a central concern, with geography especially well-placed to be central in this endeavor. 'An old definition of geography has been coming back into favor: the study of the Earth as the Home of Man—or, as we now say, of Humankind. We have recently become aware that the Earth as Home is in alarming condition, and geographers, like many others, are eager to tackle urgent problems of home repair and of remodeling the way we live' (Meinig 1992, para. 40).

Yet the human-land basis of geography is still deeper, the connection between human and Earth more fundamental than just the pragmatic concern with not fouling our own nest. Not only does our ethical concern for the environment come from a more immediate connection with the Earth, but through a better understanding of the very longest-term interplay between humans and the Earth. As Meinig observes on the relatively modern concern for human impact on the environment, 'I have no practical skills to put to use on such projects. I can only add my small voice to the few urging the need, as well, for a much longer perspective on such matters, a far better understanding of how we got to where we are. And that sort of historical investigation

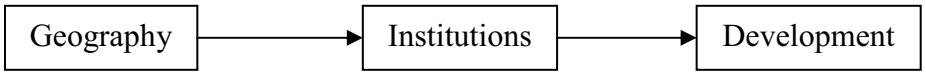
must surely lead to a sobering meditation on the human situation on this earth' (Meinig 1992, para. 40). From the long perspective, the Earth has shaped humans even more than humans have shaped the Earth. An understanding of this, of how we got to where we are, leads to an appreciation of the human-land connection still deeper than short-term pragmatic concerns about the environment.

5.8 Conclusion

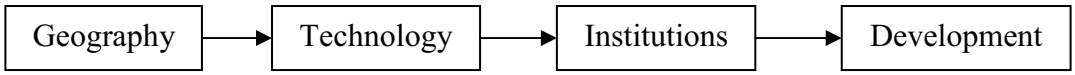
The main point of this chapter is to show that it has not been sufficiently theorized *why* geographic factors are especially salient for understanding uneven development. We have argued that the focus on process has obscured the role of 'initial conditions' in the form of geographic factors serving as 'spatially privileged' exogenous factors, that is - the only *inherently* spatially varying factor available in the study of society.

It may help to visualize this idea. McArthur and Sachs 2001 contains a number of simple causal diagrams summarizing development theories. For example, they summarize Johnson and Robinson 2001 as arguing for causality running from geographic factors, to institutions, and then to development in the first diagram below. (Their entire summary constitutes

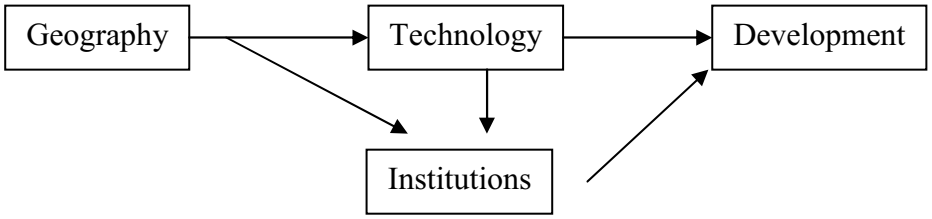
Figure 5-1 below; the short descriptions are by McArthur and Sachs):



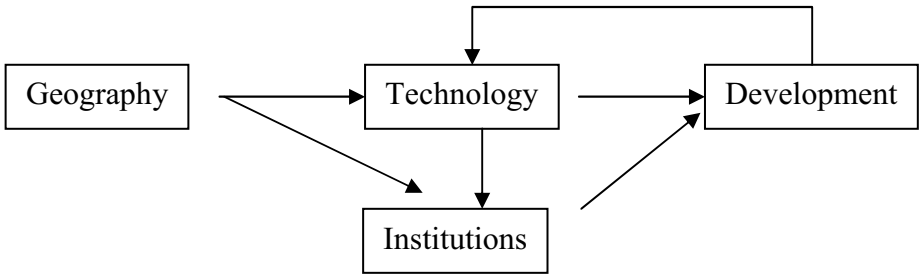
(Example: Acemoglu, Johnson, and Robinson 2001. High disease environment leads to predatory state institutions, which impede long-term development)



(Example: Engerman and Sokoloff. Tropical Ecozones lead to plantation agriculture, which promote the use of slavery, which impedes economic development)



(Example: Gallup, Sachs and Mellinger. Adverse geography diminishes agricultural productivity and health, thereby directly impeding development. Adverse geography also promotes state predation, leading to predatory institutions and poor development)



(Example: Sachs, 2000. Adverse geography has direct effects on production, and indirect effects via institutions, which both lead low levels of development. In turn, low levels of development result in low levels innovation and slow technological change. The pace of endogenous growth is thereby reduced).

Figure 5-1 McArthur and Sachs 2001, Causal Schemas of Development Arguments

However, the main point we argue here does not revolve around the addition of more boxes or arrows, or arguing for different or more complex interrelations between

these. Rather, we argue that the questions and answers above are *framed* in a fundamentally wrong way. As long-term factors with often very small, sometimes imperceptible year to year influences, geographic influence incrementally adds up over decades, centuries, and millennia to anchor social processes in one part of the world and not in another. Rather than the causal diagrams such as those above, this might be diagrammed in the following way:

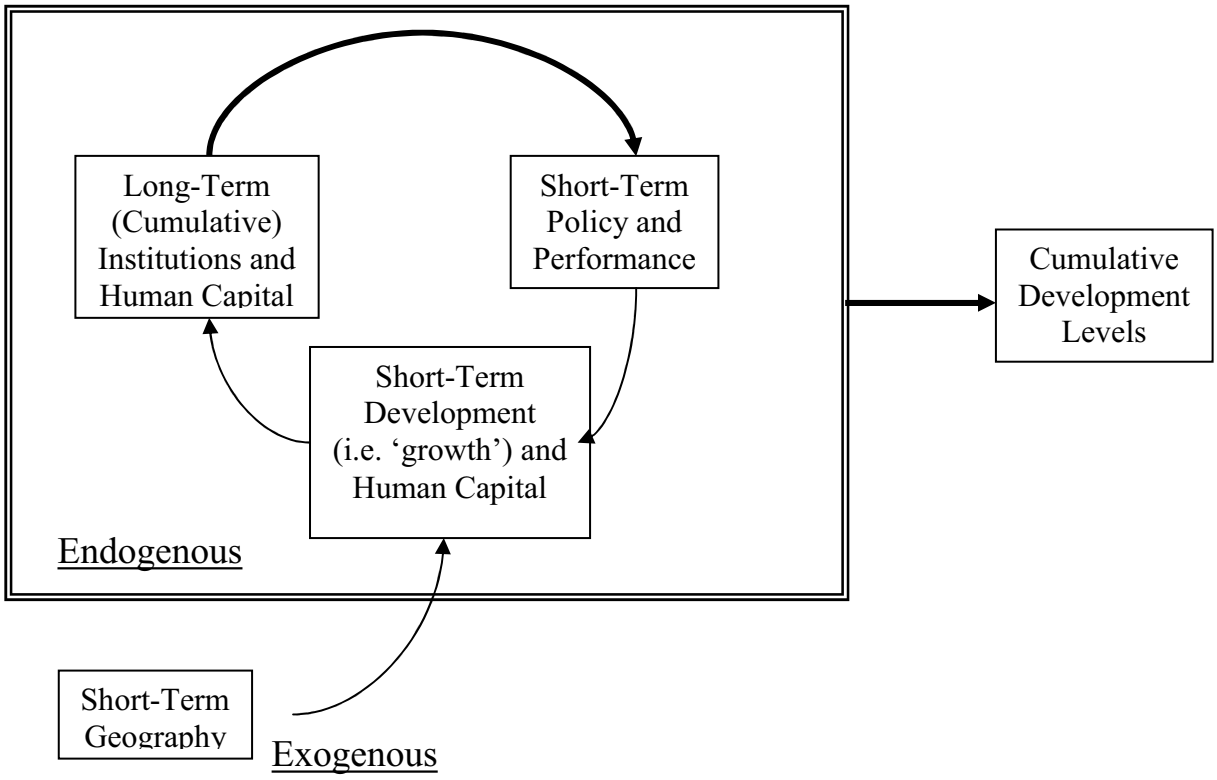


Figure 5-2 Causal Schema; Endogenous Social, Exogenous Geography Factors

Figure 5-2, rather than showing *more* factors or greater *complexity* in their interrelations, simply divides factors into exogenous and endogenous. The *endogenous* factors interact in complex ways that are not entirely understood. However, the *exogenous* spatial geographic factors have relatively simple and small effects through incentives and constraints on individual decisions. Over time, the cumulative effect is the amplification of preexisting geographic variation into patterns of social variation, the anchoring of social processes to some regions and not in others. One of the simplest yet most profound of these effects can be seen in urbanization. Historically, millions of individual decisions influenced by factors such

as transport costs led to the spatial patterns of urban development. These have in turn been amplified by subsequent urbanization-related social processes following the earlier urbanization pattern (this idea is developed further in Appendix B). Transport costs, disease patterns, innate agricultural potential and other geographic factors have subtly shaped the spatial patterns of development over centuries through independently small constraints and incentives for individuals but cumulatively large spatial influence on development outcomes.

CHAPTER 6
METHODS OF INTEGRATING GEOGRAPHIC FACTORS INTO DEVELOPMENT STUDIES AS SPATIAL 'ANCHORS'

6.1 Introduction

How can 'initial conditions', in the form of geographic factors, best be used in the social sciences? Their inherent spatiality and exogeneity is why they are needed, yet also make them problematic for many methods used in the study of uneven development. However, as we have argued, their *purpose* is also different from other social factors. These differences in both nature and purpose may make their use less problematic that is commonly thought.

6.1.1 Problems with prevailing statistical approaches

There are numerous criticisms of the use of statistics in the social sciences. Three of particular relevance to our discussion are:

1) Fit to question - statistical approaches that are sometimes successful in other areas of the social sciences are ill-suited to the study of uneven development.
2) Initial and boundary conditions - as discussed in Chapter 2 regarding the concept of 'systems' in explanation, there is likewise no clear way to divide the 'systems' considered in uneven development, that is, various regions of the world (regions, nations etc.). Spatial autocorrelation can occur due to shared origins (that is, shared initial conditions) or due to outside influence (usually stronger from nearer things), that is, a lack of truly impermeable boundary conditions.[88]

[88] Spatial autocorrelation is not usually spoken of in terms of initial and boundary conditions. Realizing that the problem is a subset of a larger problem may be useful in resolving problems associated with spatial autocorrelation by helping unify theories of explanation across disciplines.

3) Singular events – development outcomes are single occurrences that present problems for statistical analysis.

6.1.2 Fit of methods to questions

The reliance on statistical techniques, especially multiple regression, in development studies is largely an artifact of these studies developing first in the context of policy analysis and short-term economic trends, and only later shifting to a context of long-term geographic and sociopolitical factors. In economic and political science studies there are units of measurement (money and survey data) suitable for multiple regression. Furthermore, using nations as case units in short-term studies is defensible because the units fit the variation (policies are usually contained within political borders) and there are likely fewer reasons short-term policies should be spatially autocorrelated across borders.

However, in moving from short-term policy studies to looking for the 'deep' determinants of growth as recent studies have done few of these congruencies between the questions asked and methods remain. Survey data and money have natural metrics, but geography, and even less cultural and institutional factors, are not nearly so easily quantified. Furthermore, the geographical and institutional variables that are considered in these more recent studies often do not vary closely or at all with state or other political borders. For example, geographical factors such as soil productivity, disease environments, water transport potentials and so on vary largely independently of state borders. Similarly, social factors that might influence institutional development often vary at least partially independently of state borders, such as religion, some language groups, or colonial histories (for example, Latin American countries subdivide a larger colonial area; conversely, countries such as the United States, Canada, South Africa and Russia cut across or encompass multiple colonial histories and cultural groups within single country borders). Also, data suggests that the scale of spatial autocorrelation is much larger than most national units for the degree of relevance considered. That is, there is relatively little substantial variation between countries *within*, for example, Western Europe, Africa, or South America. As measured by a substantial difference in material well-being, the primary variation occurs between only a small number of large world regions. This presents a problem for statistical approaches because it reduces the number of units

for analysis (this problem is considered in more detail in Section 6.5). Thus in many ways the statistical methods used do not fit the questions asked about uneven development, especially questions raised in recent theories that deal with geographic factors, long-term institutional change, and inherently spatial questions (such as patterns of colonization, agricultural productivity, or disease).

One particularly relevant area in the development literature where the shortcomings of statistical approaches to development are apparent is in the growth literature. Statistical methods find that a large amount of what seems to drive growth lies in the 'residuals', in the mysterious so-called 'total factor productivity' (TFP).[89] This is commonly attributed to dynamically changing factors, especially technological development (Easterly and Levine 2001 provides a clear overview). Long-term, institutional and evolutionary approaches may be able to answer some of these questions, and the methods we discuss here are complementary to those approaches. The significance of factors related to TFP such as institutional development and increasing returns constitute an area of future research, and are considered further in Chapter 8, Section 8.2.

6.2 Apparent Populations

As mentioned above, one of the fundamental challenges to statistical approaches to the study of uneven development (considered in more detail in Section 6.5) is that of spatial autocorrelation. All too frequently there is little or no effort to correct for this problem in social science research.[90] However, at least the problem is generally *recognized* as existing. There is another problem that is seldom even recognized in the social sciences, yet crucial for development studies.

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[89] Similarly, discussing international relations/political science research, Gartzke argues that 'War is in the Error Term' (the title of his 1999), suggesting the degree to which in political science statistics as in development statistics much of what is of interest for achieving satisfying explanations is unsuitable for statistical analysis.

[90] One of the rare papers to focus on this problem in comparative political economy is by Ross and Homer (1976), and much of the literature they cite merely represents debates within anthropology on Galton's problem and diffusion among relatively small cultural groups (mentioned in Section 6.5). Bollen et. al. (1993), in a survey of 108 large-scale comparative sociology research books and articles, found that only five percent considered the problem of the non-independence of cases (and again, a number of these are from anthropologists using Murdock's stratified samples). The last decade has not seen a significant increase in attention to the problem in the major social science publications.

Often, social scientists are interested in the relation between social factors without an interest in their spatial distribution. Probability sampling (in surveys) and random assignment (in experiments, or simulated in natural experiments) is relied upon to generate data through *known* probability procedures, where it is possible to formally represent the uncertainty that results (Berk et. al. 1995, 424).

However, the data used in comparisons of development represent what have been called 'apparent populations'. They represent all or virtually all of the universe of possible observations. *Even if* these observations were truly independent and spatial autocorrelation were not a problem, frequentist statistical inference is simply not applicable to this data, as it does not represent a probability distribution but is actually the entire universe of data. Several possible approaches have been suggested in this case. One is a Bayesian approach, which we doubt is capable of overcoming the problem (for the reasons cited in Firebaugh 1995, as well as the more general problems with Bayesian statistics, e.g., Efron 1986). Another is that the data be treated *as if* it is part of a repeatable process (what has been called a 'superpopulation'). This of course raises metaphysical questions related to determinism, and why one would assume that there would be different outcomes under imaginary repetitions. As Western and Jackman emphasize, 'It is simply not relevant for the problem at hand to think of observations as draws from a random process when further realizations are impossible in practice and lack meaning even as abstract propositions. In short, frequentist inference answers a question that comparative researchers are not typically asking' (Western and Jackman 1994, 413).

Finally, one could simply eschew statistical inference as unnecessary because in a nonstochastic setting all the data is collected. This position 'is certainly valid, but it still commits the researcher to a substantive theory of how the data were generated…the researcher is effectively claiming that things could not have been different, that the data were generated by a completely deterministic process…If we could set in motion, once again, the historical conditions [initial conditions] that gave rise to the data, would the ensuing process generate a data set identical to the one actually obtained? Commitment to this type of determinism is the cost of abandoning statistical inference' (Western and Jackman 1994, 413).

Similarly: When data are comprised by the whole population

> the data may be treated as a (fixed) population…Descriptive summaries of the population can be used…It cannot be overemphasized that a completely deterministic world is necessarily assumed, at least with respect to sampling error. If the data could not have been different because of sampling error, the data-generation process is effectively deterministic by default. Disparities found in attempts to replicate the results are caused by other kinds of error or substantive differences across sites or historical periods, not sampling error. In our example, this implies that if the historical process for the particular period and for the particular country [or countries] in question could be started again, the data would turn out exactly the same. Put another way, given the conditions extant in the beginning of the period, one (and only one) set of events could have unfolded. Should such a conception of historical processes be disconcerting, the alternative is to introduce the possibility of stochastic historical process (Berk et. al. 1995, 425-426).[91]

[91] As Milan Kundera wrote regarding Czech history, 'If Czech history could be repeated, we should of course find it desirable to test the other possibility each time and compare the results. Without such an experiment, all considerations of this kind remain a game of hypotheses' (1984, 223). Economist Georgescu-Roegen makes a similar observation and links it both to initial conditions and economic development: 'We may recall in this connection the elementary remark of C.S. Peirce that universes are not as common as peanuts. Because there is only one Western civilization, the question of whether its historical development merely follows a trajectory determined entirely by the initial condition or whether it represents a hysteretic process can be settled neither by an effective experiment nor by the analysis of observed data. Unfortunately, the answer to this sort of question has an incalculable bearing upon our policy recommendations, especially those with a long-run target – such as the policies of economic development' (Georgescu-Roegen, 1966, 65).

Figure 6-1 Visualizing the 'Superpopulation' Assumption
Manufacturing Globes in Italy. The assumption that we can treat the world as part of a 'superpopulation' is something like the idea that endless worlds roll off an assembly line, usually with the additional assumption of indeterminism - that each world is different from the others.[92]
Image by Sandro Michahelles in Povoledo 2007

It seems that the problem of apparent populations *forces* the researcher, even if the issue is purposefully ignored, either to make a metaphysical commitment to indeterminism and treat the data as part of a superpopulation, or to accept it as the outcome of a single 'run' from some initial conditions, and treat the data merely with descriptive statistics.[93] If one assumes that, given another try, things could turn out differently, then one is committing to the metaphysical position of indeterminism (see also the discussion in Section 3.3). Crucially, even if one does commit to indeterminism and the idea of a superpopulation, this is *still* no solution to the problem. There is no way to know which 'draw' from the superpopulation our world represents. 'Take the example of a confidence interval for a mean where we can conclude that under repeated realizations (which are acknowledged to be impossible), the interval would cover the true mean 90% of the time. *We have no way of knowing*

[92] E.O. Wilson observes that 'if ten thousand humanoid histories could be traced on ten thousand Earthlike planets, and from a comparative study of those histories empirical tests and principles evolved, historiography—the explanation of historical trends—would already be a natural science' (Wilson 1998, 9).

[93] Thus the frequent mention of the problem of determinism and indeterminism in development studies is not just some relic of past discussions on geographic factors in development. These arguments repeatedly arise in discussions of development because they are an *unavoidable* aspect of the methodological assumptions necessary in attempting to answer these questions. Recognition of this fact is a key factor motivating this dissertation – like it or not, these issues must be dealt with explicitly and clearly as they *fundamentally* shape the design and interpretation of development studies, even when researchers believe they do not.

whether the current interval is one of the fortunate 90% and no possibility of further replications.' (Western and Jackman 1994, 414, emphasis added).

As with questions of location, development studies more generally ask questions with answers that are due to local context and (contingent) unique outcomes. They are not found in regularities but in outcomes that are unrepeatable results stemming from initial conditions. Descriptive statistics seem to be the only way to deal with such a nonstochastic situation. Indeed, in discussing Hoover's assertion that 'Econometrics is not about measuring covering laws' (Hoover 2002, 173) Kittel argues that 'accepting this rescue of the econometric methodology drowns the very ambition of macroquantitative research.' If econometrics is not about searching for covering laws 'then the approach gives up the aim of testing theories assumed to be independent of space and time; *it becomes a highly sophisticated variant of descriptive statistics*' (Kittel 2006, 11, emphasis added). Although Kittel says this in *defense* of theory testing 'independent of space and time', we believe he has inadvertently 'hit the nail on the head': What is needed to answer the kinds of questions comparativists ask, especially the spatial questions, are better and clearer (generally *less* 'sophisticated') descriptive statistics. Simply put, there is no magical new information supplied by frequentist (nor Bayesian) statistics that can make up for what these lack vis-à-vis the study of uneven development, i.e., inherent spatiality. 'Shoe leather' – more facts about initial and antecedent conditions and their amplification is all there is.[94] However, this is not as limiting as it may seem. Indeed, just as frequentist statistics are well suited for some of the questions social scientists ask, descriptive statistics may be more useful in questions related to uneven development than has been realized.

6.3 Visualizing Data – Fit to Data, Question, and Cognition

[94] The statistician David Freedman (1991) argues that what is needed in the social sciences is not more technique but more 'shoe leather', i.e., researchers creatively finding or developing more and better data. Similarly, Klass (2006) has recently argued for 'JPDA' in political science - 'just plain data analysis' - in line with the statistical rejection of assuming 'superpopulations' and instead treating data as descriptive statistics. The work of Paul Bairoch (1988, 1993) is perhaps exemplary; it sheds light on long held questions and theories concerning geography, development, and related issues, not through the use of sophisticated statistics, nor complicated theories, but through exhaustive research and the careful but simple presentation of highly relevant descriptive statistics.

One very positive aspect of statistical approaches to the study of uneven development has been the creation of very large and extensive datasets, often using ingenious methods to attempt to quantify difficult to measure concepts theorized to be useful in understanding development outcomes. If, as we argue, there are severe limitations in the statistical approach to uneven development, how can these datasets be used? We argue that the creative use of descriptive statistics through tabular analysis and maps can be combined and are especially suitable for the study of uneven development. These methods are better because, unlike other methods, they

1) fit the data
2) fit the question
3) fit human cognition

The creative use of descriptive statistics and maps we discuss below is similar to developments in understanding the underlying meaning of statistical relations in a visual way such as described by the concept of 'Teaching Introductory Statistics Courses so that Nonstatisticians Experience Statistical Reasoning' (Bradstreet 1996, further developed in, e.g., Castle 2006). These methods leverage some of the stronger, less esoteric insights of statistics while maintaining the information conveyed by spatial relations and knowledge of the cases.

When this type of reasoning is applied to spatially juxtaposed data with different factors distinguished by size, shape, color and value indicators it becomes a powerful cognitive tool. 'Bertin (1983) identifies seven variables that are available for processing information using graphs. Of these seven, shape and colour are considered to be key to the development of good visualization tools for the purposes of categorical analysis, size, value and colour for the purposes of quantitative data analysis- that is for helping the viewer to notice patterns in the data' (Haining 2003, 192). Maps combine the attributes of fealty to the original data (they avoid many of the change of support problems [COSP] that arise when converting spatial data to numerical lattice data) while at the same time being inherently suitable for the conveyance of data with spatial, shape, and color properties. Especially regarding spatial questions such as uneven development, in contrast to the output of statistical manipulations, maps are *inherently* suited to both qualitative and quantitative analysis.

In the social science literature besides human geography maps and other visual tools are seldom relied on to express or test theories (Orford et. al. 1999; surveying

more recent social science literature makes clear that this trend has improved at best only slightly). Indeed remarkably, *even in geography* the use of maps has become rare (Martin 2000b). Yet maps are able to convey a great deal of information with many of the benefits that we discuss below concerning descriptive statistics (maintaining case identity, spatial juxtaposition) in a manner that is fundamentally compatible with human cognitive skills. Data expressed with visual methods, ranging from tabular analysis to maps and beyond[95] allow researchers to effectively express subtle and complex meanings or *gestalts* (Cleveland 1994, 224) with the same data that might otherwise be used in regressions and other statistical methods. Indeed, one could argue that the form of presenting data in statistical arguments is highly maladapted for many of the purposes in the social sciences. As Haining notes, 'Cleveland (1993) argues that the human eye and brain are good at detecting patterns and relationships from visual evidence when that visual evidence is presented and the visual displays engineered in ways that are grounded in perceptual and cognitive psychology' (Haining 2003, 192). Proper use of descriptive statistics and maps, especially when combined, can be used to convey statistical reasoning.

Although descriptive statistics and maps are commonly viewed as overly simple or unrigorous, they are free from many of the problems that plague statistical methods, especially concerning spatial statistics, such as opacity due to their technical nature, their dissonance with human cognition, the manner in which case identities are lost, and many other problems discussed in the literature. The criticism that maps are overly amenable to individual interpretation loses its persuasiveness once the degree to which competing statistical methods devolve into incompatible interpretations and conflicting and recondite (and thus opaque) 'corrections' is appreciated.

It is difficult to see what advantage is gained from reducing inherently spatial data (social lattice data) to a non-spatial form with numerous known serious drawbacks in both its manipulation (change of support problems [COSP], the modifiable areal unit problem [MAUP] etc.) *and* its presentation (i.e., known incompatibilities of statistical

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[95] Much of the recent literature on visualization, ESDA (exploratory spatial data analysis), and so on is concerned with leveraging the power of computers to form highly sophisticated (three-dimensional, interactive etc.) data manipulation. While promising, we believe there is a risk of over-complication and of forfeiting many of the advantages of visual methods that lie in their inherent simplicity and suitability to human cognition.

output tables with human cognition[96]), compared to the alternative of maintaining the spatial form of data (that is, as mapped data) that simultaneously avoids many change of support problems while also being inherently suited for human cognitive abilities. To claim the former is 'rigorous' while the latter is not seems to ignore the goal of most data analysis and explanation in the social sciences. While it is true that an audience may leave a presentation supported by tabular analysis and maps with conflicting interpretations of the argument, it is at least equally as likely that an audience will leave a presentation supported by statistical manipulations of the same data with conflicting interpretations of the argument. In the former case, however, there is less chance that the data distorts reality and simultaneously good evidence (e.g., Bertin 1983, Cleveland 1993, 1994, MacEachren 2004) that the audience will leave with a fuller (and longer lasting) assimilation of the data and greater potential for personal discernment of its plausible meanings than in the latter case. In the statistical case the audience must often discern between conflicting arguments solely on the basis of competing interpretations of highly opaque statistical methods.

6.4 Use of Descriptive Statistics

Shalev (1998), pointing out the many limitations and unsupported assumptions of statistical methods in political economics, has developed a subtle discussion of the benefits and appropriateness of descriptive statistics in political economics. Shalev's observations are especially useful vis-à-vis the use of spatial data for anchoring otherwise aspatial social theories.

6.4.1 Shalev's discussion of descriptive statistics

Shalev (1998) demonstrates an alternative method to multiple regression relying on a descriptive tabular format that identifies different combinations of conditions or causes with the cases that carry them. This method is able to provide evidence of nested causal effects, syndromes of cause and effect (i.e. interaction), and highlights what cases may reveal further causal relations beyond the original hypothesis. To illustrate Shalev's argument we consider two of his examples from the political

[96] A well known demonstration of the superiority of simple visualization of data versus statistical tables is provided in Tufte (1997, 38-54) concerning the 1986 space shuttle Challenger disaster.

economic literature, followed by an example of how this approach can be applied to more recent discussions of uneven development.

6.4.2 Two examples

In a widely cited paper, Bo Rothstein (1990) studies the cross-country variation in union membership in 18 OECD countries, and why it is particularly high (over 70%) in only a few of these. He focuses on the 'Ghent system' where unions are responsible for administering unemployment insurance, which has the effect that in periods of economic crisis union membership is unlikely to decrease and may even increase. In addition to the presence/absence of the Ghent system, however, are other possible causes of high union membership, such as high left party participation in government and total potential union membership (the absolute number of employed and unemployed wage earners).

Rothstein uses multiple regression to attempt to discern which of these factors are important, and to what degree. Shalev slightly modifies[97] and replicates the regressions, with the following result (coefficients are standardized *betas*):

Union Density= .47(Ghent) + .28(Left Government) - .34(Log of Potential Membership)

The coefficients are significant at standard levels (with Left Government only marginally so) and the adjusted R-squared is .73. The coefficient for the Ghent variable shows a substantial net difference between Ghent and non-Ghent systems of 27 percentage points.

Although this regression seemingly supports Rothstein's hypothesis, there are several problems, especially concerning the common assumption that the explanatory variables are exerting independent rather than interdependent effects. This problem is compounded because, with only 17 cases, it would be impossible to add even a few other factors into the model, which limits further use of controls or modeling of interaction effects. Shalev proposes that a multiway flowchart showing different unionization values with countries clustered by cross tabulation based on categorical versions of Rothstein's measures on other causal variables both more clearly supports

[97] Including dropping Iceland from the analysis, giving 17 cases.

Rothstein's argument as well as points out possible further avenues of research (Table 6-1).

Table 6-1 divides the group of countries into small and large, and then further subdivides these by the strength of Left parties and into Ghent and non-Ghent systems. Beside each case is the percentage of union membership, and the mean of membership for each class. Shalev argues that this 'unsophisticated' method of presenting the data 'vindicates Rothstein's thesis much more effectively than his regression. It makes clear precisely the things he wants to demonstrate: that the Ghent effect is large and not spurious, and that it comes into play in the countries where other conditions are broadly favorable to unions' (Shalev 1998, 13).

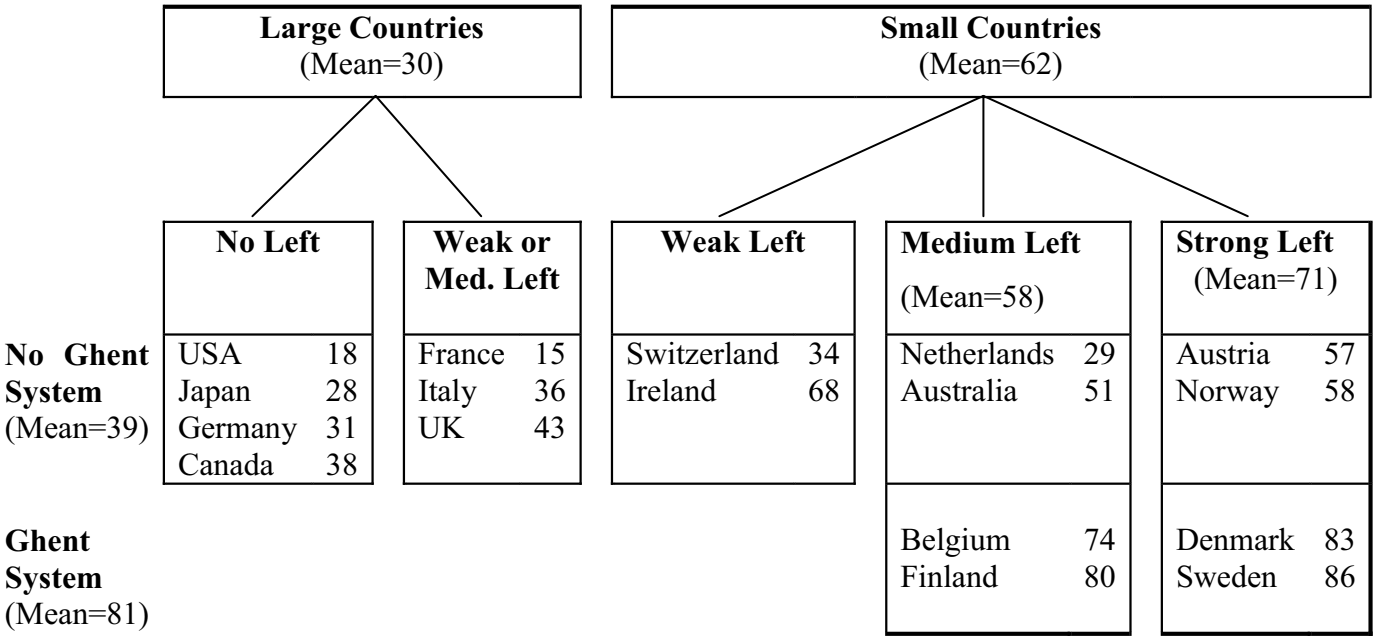

Table 6-1 Reanalysis of Rothstein (1990) by Shalev (1998)

Equally important, this method points 'the interested researcher to the most fertile questions for selective case comparisons that might help nail down how important Ghent really is. In particular, it must be questioned whether the Ghent system alone can explain the very large differences in density between the members of two otherwise well-matched pairs of countries: Belgium and the Netherlands, and Sweden and Norway' (Shalev 1998, 13). Other factors seem likely to explain these particular cases, such as the fact that Belgian unions are present in the workplace, whereas in the

Netherlands they are not. The difference between Norway and Sweden may be attributable to differences in sectors in the countries, such as differences in gender in the workplace, private sector trade and services, and percentage of white collar workers. Two other anomalies the chart suggests deserve further research are the wide gap between the United States and Canada, and the unexpectedly high union membership in Ireland.[98]

Crucial for better analysis of development data, however, is that this method makes clear where further research might be pursued, what factors drive what particular clusters of cases, and as in the pairs 'Belgium-Netherlands' and 'Sweden-Norway', what additional factors might be confounding the results. Few or none of these insights are obtained from Rothstein's original multiple regression analysis. The more technically sophisticated method of multiple regression is less useful than Shalev's tabular flowchart using the same data for supporting Rothstein's hypothesis and pointing out where other variables are important.

A second example used by Shalev is based on a study of the common idea in political economy that independent central banks have a strong favorable effect on economic performance. Hall and Franzese (1998) argue that while it is true that independent central banks are anti-inflationary, they can have negative effects on unemployment; specifically, in economies with uncoordinated wage bargaining, central banks might fail to respond to employment signals, resulting in higher unemployment. Using data for 18 OECD countries over the period 1955-1990, they support their argument first in a simple tabular format (without case identity), and then with the application of multiple regression with controls for economic, political and institutional variables. Although Shalev notes that their regression analysis is of very high quality, it is 'heroic' to think that 18 observations can statistically support an argument based on 9 independent variables (including interaction terms).[99]

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[98] All of these observations are by Shalev.

[99] Hall and Franzese use pooling of data to increase their sample size. This method is not useful for the long-term questions of recent development studies where it is precisely the influence *on* cross-sectional variation *from* longitudinal variation that is of interest. Even in short-term studies Shalev and others argue that pooling as a method of increasing sample size has serious problems, especially the assumption that cross-sectional and longitudinal variation are comparable. As Shalev concludes, the 'most likely consequence of a turn to pooling is to muddy the causal waters still further' (Shalev 1998, 17).

Table 6-2 shows the data from Hall and Franzese divided by five categories on the coordination measure and three categories on the central bank independence measure. The lower table shows the corresponding real cases.

	Coordination of Wage Bargaining					
Central Bank Independence	0	0.25	0.5	0.75	1	*Mean*
Low (<.4)		1.3 5.6			2.0	2.7
Medium	4.9 8.1	4.1	4.9	3.3		**4.5**
High (>.6)	6.1			0.9 3.1	2.2	3.7
Mean	6.3	3.8	4.9	2.8	2.0	3.9

	Coordination of Wage Bargaining					
Central Bank Independence	0	0.25	0.5	0.75	1	*n*
Low (<.4)		ITA NZL			NOR SWE	4
Medium	IRE UKG	AUS FRA	BEL NET	DEN FIN JAP		9
High (>.6)	**CAN** **USA**			**SWI** **GER**	**OST**	5
n	4	4	2	5	3	

Table 6-2 Reanalysis of Hall and Franzese (1998) by Shalev (1998)

One weakness in their argument the above chart makes clear is that it is in the group of countries with medium central bank independence that unemployment is highest. However, this might be explained by the controls Hall and Franzese use in their regression (although again, the meaningfulness of these are questionable in such a small sample size). The hypothesis that in countries with strongly independent central banks coordinated wage bargaining reduces unemployment is supported by the unemployment difference between Austria, Germany and Switzerland versus uncoordinated North American countries. However, Shalev argues that Hall and Franzese need to persuade us that 'it is indeed coordination, rather than factors like economic openness or the political representation of labor, which explains this specific gap' (Shalev 1998, 16). Crucially, the phrase 'North American' alerts Shalev to the possibility that spatial autocorrelation might be a problem; 'each one of these sub-groups of countries constitutes a cultural, political and economic region with numerous internal similarities but which is worlds apart from the other. Regression's

assumption of the independence of characteristics that cluster so strongly appears particularly misplaced in such a context' (Shalev 1998, 16).

Shalev does not use the phrases 'spatial autocorrelation' or 'Galton's problem', (indicative of the degree to which these problems are generally ignored in comparative political economy). The important point, however, is that although almost in passing, Shalev has recognized that spatial autocorrelation is a problem for cross-country comparative political economy, and has shown how tabular analysis with case identity maintained allows for data gathered for multiple regression analysis to be analyzed in a way that is sensitive to this problem, as well as to the problems of a small number of cases and the interaction of factors.

We propose that combining the methods such as those Shalev demonstrates for reanalyzing the arguments by Rothstein and by Hall and Franzese with other forms of visualization of (especially) spatial data is most appropriate for the study of uneven development. Crucially, besides fitting the type of problem (i.e. small-N comparative political economy with spatial autocorrelation and factors with interdependent effects) better than multiple regression this method allows for the immense archival and creative effort put into constructing relevant datasets originally intended for multiple regression to be leveraged for further analysis.

6.5 Boundary Conditions as Spatial Autocorrelation

Previous sections have mentioned that inattention to spatial autocorrelation is a problem in cross-country econometric studies. The main problem spatial autocorrelation poses is that non-independence of cases undermines the claims of statistical significance of these studies (and leads to Type I errors). We find that there is good evidence that at the desired degree of relevance (i.e., *substantial* variation in material well-being and related social indicators) there are likely far fewer cases of regions with significantly different development trajectories than there are countries in the world. Once spatial autocorrelation is identified as important to econometric studies, the primary problem for analysis becomes the small number of cases. Ideally, there would be many worlds with slight differences in variables between each (i.e., a 'superpopulation') to statistically simulate experimental controls in our observational data. Lacking this, a large number of substantially independent cases of development could be usefully leveraged for analysis. However, unfortunately, the universe of

countries simply does not seem to provide a large set of independent development cases.

There are statistical measures of the degree of spatial autocorrelation in a dataset (e.g., Moran's I, Geary's C). However, if there is direct information concerning the reason a dataset shows spatial autocorrelation, this more direct data is more useful than a simple statistical summary. Because there are many complex interactions over a long time period of social, economic and political factors, and these are known to some degree, historical analysis provides a more direct and useful way to judge the extent to which there are areas of relatively independent growth trajectories.

It is perhaps surprising that economists and others social scientists dealing with cross-country comparisons have not looked to the discipline which has the longest history of dealing with spatial autocorrelation, anthropology. The first formal critique of spatial autocorrelation in the social sciences was by Galton in reference to the first (1889) extensive comparative study in the social sciences by the 'father' of anthropology, Edward Tylor, and became known as the Galton-Tylor problem in that field (Ross and Homer 1976). Although cross-cultural research was subsequently largely rejected in anthropology,[100] a remarkable exception is found in the work of George Peter Murdock, leading to the foundation of the enormous data files, the Human Resource Area Files (HRAF), at Yale University. His work towards a global dataset for cross-cultural comparisons (*Social Structure*, 1949) confronted Murdock with the problem of autocorrelation (at the generally smaller scale anthropologists often deal with), leading to the classification of cultures to allow for what he called 'stratified probability sampling', the random selection of cases from regions classified by their relative degree of historical non-interaction. Murdock later divided his earlier work into 412 culture clusters in the *Ethnographic Atlas* (1967). This was still not found to satisfactorily separate the effects of cultural diffusion (Chaney and Revilla 1969) and further efforts were made to deal with the Tylor-Galton problem. This led to the reclassification into six major groups, each further divided into 25 subgroups

[100] The relativistic nature of anthropology, that also became deeply embedded in geography partly through Sauer's influence from Boas through contact with Kroeber and Lowie at Berkeley (Mitchell 2000, 25), has meant an anti-comparative position. Generally, anthropology became deeply relativist and thus cross-cultural research was largely rejected in the 20th century. As Graeber (2004, 96) notes, 'While anthropologists are, effectively, sitting on a vast archive of human experience, of social and political experiments no one else really knows about, that very body of comparative ethnography is seen as something shameful…it is treated not as the common heritage of humankind, but as our dirty little secret.'

for stratified probability sampling (Murdock, *Atlas of World Cultures,* 1981).[101] The six major groups are:

1) North America
2) South America
3) Europe/Circum-Mediterranean
4) Sub-Saharan Africa
5) Asia (East and South)
6) Oceania

This basic division is supported by many other classifications by other scholars. For example, Gaisford (1978) divides regions of maximum internal interaction in the following way:

1) North America/Caribbean
2) Central/South America
3) Europe
4) Middle East/North Africa
5) Sub-Saharan Africa
6) Soviet Union/Mongolia
7) India/South Central Asia
8) China/East and Southeast Asia
9) Australasia/Pacific

And Olsson and Hibbs (by the independent development and diffusion of food production systems, based on anthropological and archaeological works):

1) North America
2) South America
3) Central America
4) Near East, Europe, North Africa
5) East Asia
6) Southeast Asia
7) Sub-Saharan Africa
8) Indonesia, Philippines, Papua New Guinea
9) Australia, Pacific Islands

[101] In still another strand of social science literature from that discussed in Chapter 1 geography is also controversially found to relate to social distributions; sociologist Geert Hofstede (1981, 2003) finds strong correlations of latitude with his cultural 'dimensions' (for recent critiques and defense see McSweeney 2002a, 2002b, Hofstede 2002, Williamson 2002, and Baskerville 2003). Baskerville also discusses the similarity of this work with the cross-cultural work of George Peter Murdock and how both were rejected because of relativist objections to comparing cultures.

The grouping of Europe with the Mediterranean by Murdock and Olsson and Hibbs reflects the long-term view of anthropology, where European culture has deep influences from Roman occupation and shared religious and cultural roots with North Africa and the Near East. Also, differences among scholars reflect the fact that divisions between some regions are less clearly defined than between other regions, for example, the division of Southeast Asia or attempts to divide an eastern (Slavic speaking or Orthodox) Europe from western Europe. These in-between cases of diffusion and historical connections represent the most difficult analytical challenge in considering world regions.

The similarity in these divisions by scholars from different disciplines and time periods suggests these divisions are robust. The (relatively minor) differences in grouping largely reflect the focus of the disciplines and individual research. However, still more detailed historical analysis is useful to divide the regions in a way that maximizes the independence of development trajectories between them.

The most thorough recent consideration of a global division based on historical cultural influence and known trade and economic ties is that by Lewis and Wigen (1997). They address the problem of differences in the degree of separateness between regions by following the eminent historian of the Middle East, Marshall Hodgson, in dividing the world based on degrees of separation represented by lines of differing thickness. This is useful in that it recognizes that while there are very real differences stemming from the historical independence of world regions, these vary in their degree (another aspect that would be difficult to capture in multiple regression comparisons). Because the interactions between regions occurred over a long time period, they analyze the world in 1200 AD, with thinner lines representing greater cultural and economic influence (Figure 6-2).

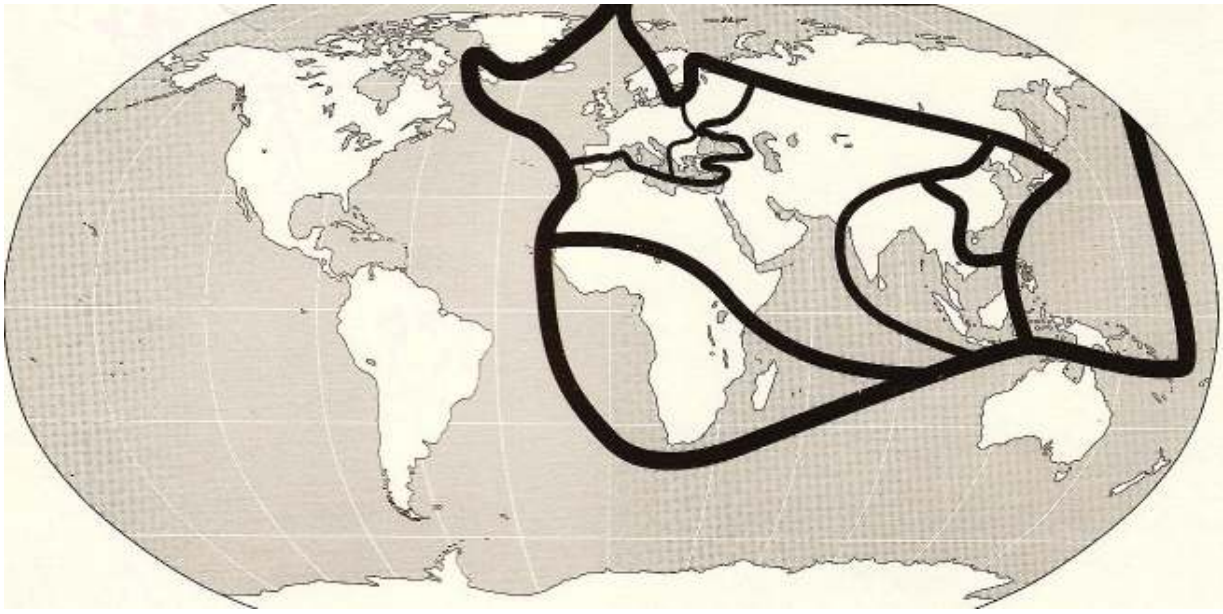


Figure 6-2 World Regions, circa 1200 AD, with line width signifying degree of cultural separation
Source: Lewis and Wigen 1997, 145

The greatest division is between Africa/Eurasia and the 'New Worlds' of the 'Antipodes' and the Americas. The next greatest divisions, areas of the most independent development within the Afro-Eurasian ecumene, are sub-Saharan Africa and East Asia. After this is the division between the East Asian/Indic world and the lands of Abrahamic traditions to the west. Note that only a thin line divides the Christian from the Muslim Abrahamic areas, and the least important division is between the orthodox and Catholic branches of Christianity (both lines that many 'Westerners' often probably perceive of as of relatively greater significance than they in fact merit from a global perspective). These areas all shared similar institutional, political, religious, technological, legal and cultural development for millennia.

After several hundred pages of analysis, Lewis and Wigen decide on the contemporary map of world regions shown in Figure 6-3. Although in appearance this map is similar to world regional divisions in older atlases, the borders in Figure 6-3 are based on very careful consideration of inter-regional political, cultural, and linguistic ties, migration and economic interaction and influence. Furthermore, where there are questions about particular borders, the historical arguments for the division and alternatives are available in the text and hence very transparent. Thus Figure 6-2 and Figure 6-3 provide the basis for the world divisions that seem to offer maximal independence of development trajectories. For the time periods between 1200 and

2000, analysis of the text in Lewis and Wigen and intermediate maps such as the numerous detailed maps in Barraclough (1994) are sufficient to delineate world regions in important time periods (such as 1500, before colonization, and ~1750, before industrialization).

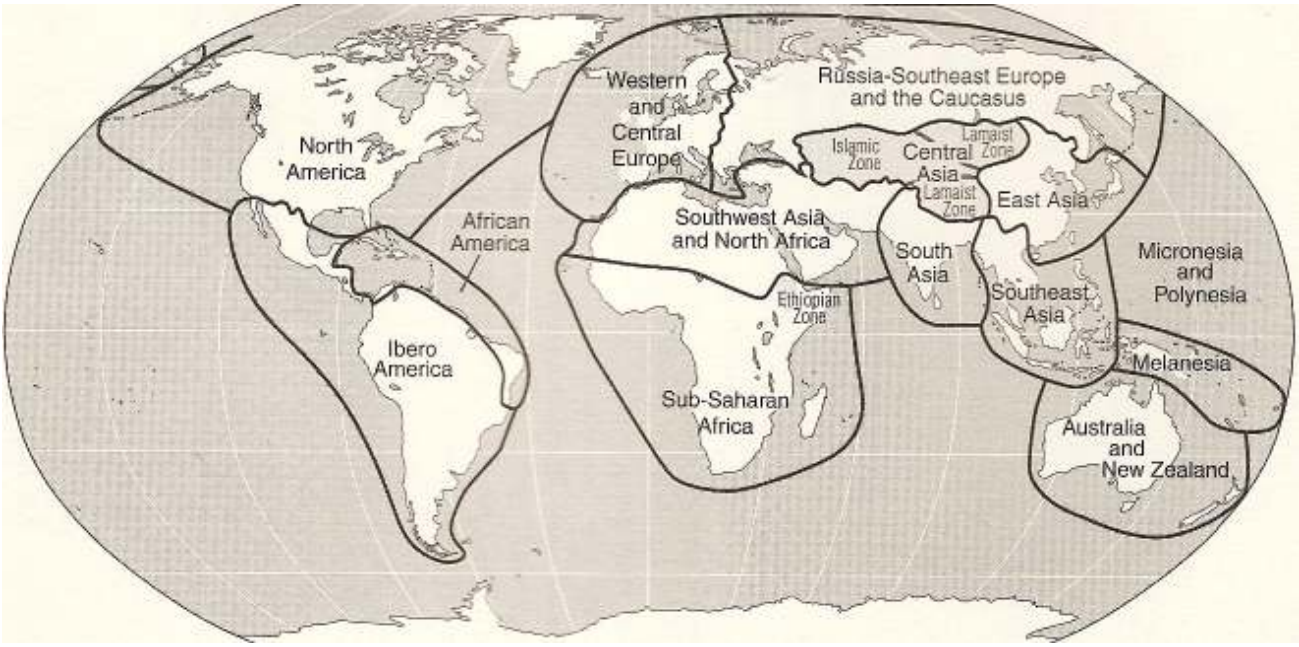


Figure 6-3 World Regions circa 2000 A.D.
Source: Lewis and Wigen 1997, 187

The robustness of Lewis and Wigen's divisions is demonstrated through the similar divisions by other scholars. For example, Samuel Huntington divides the world (largely based on religion) in Figure 6-4. The differences with Lewis and Wigen are minimal, while such details as the religiously fragmented nature of central Asia and the special case of northeast South America support the conclusions of Lewis and Wigen on these especially complex areas. From a more geopolitical and world system perspective, the global divisions by the geographer Cohen (2003, Figure 6.5) further demonstrate the considerable agreement among researchers on these questions, with northeast South America again separated from the rest of South America, the appearance of a separate Central Asia world region, and the Horn of Africa noted as a difficult area to classify. Cohen, like Lewis and Wigen, also distinguishes more and less distinct divisions ('realms' versus 'regions').

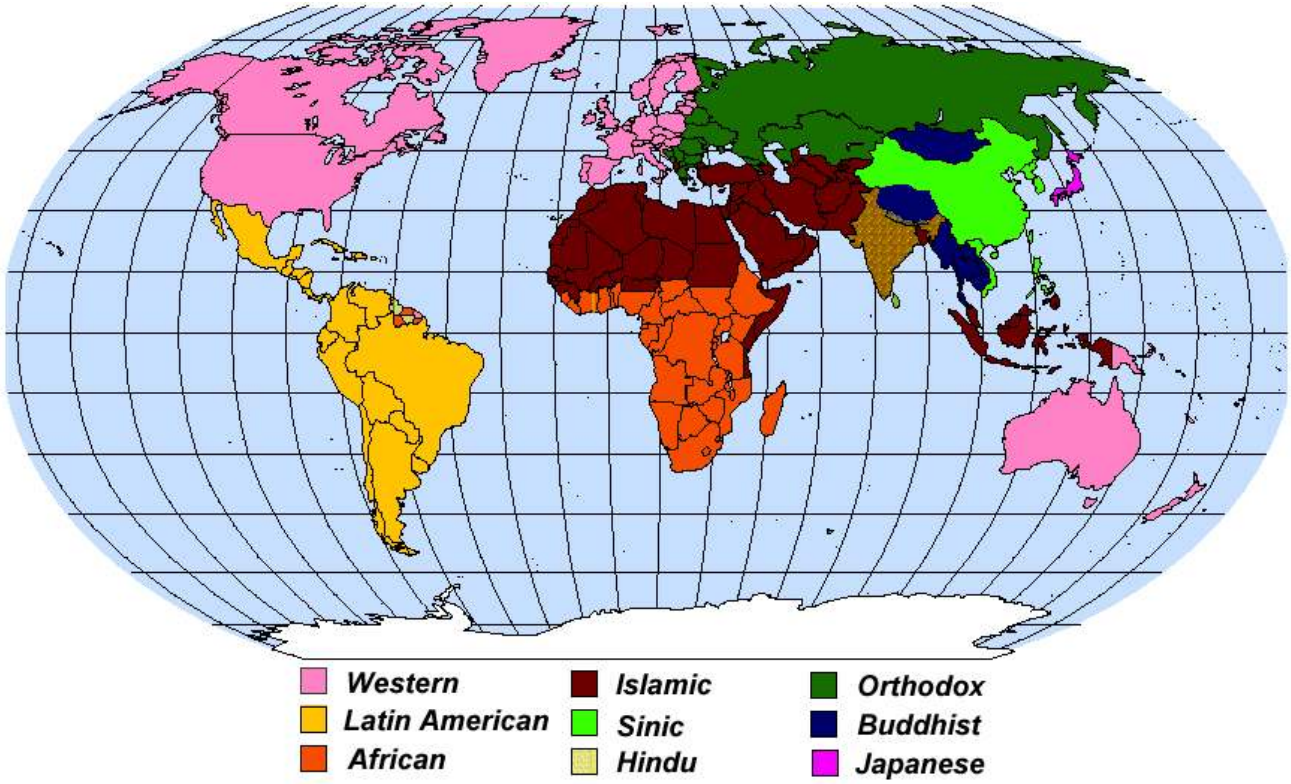
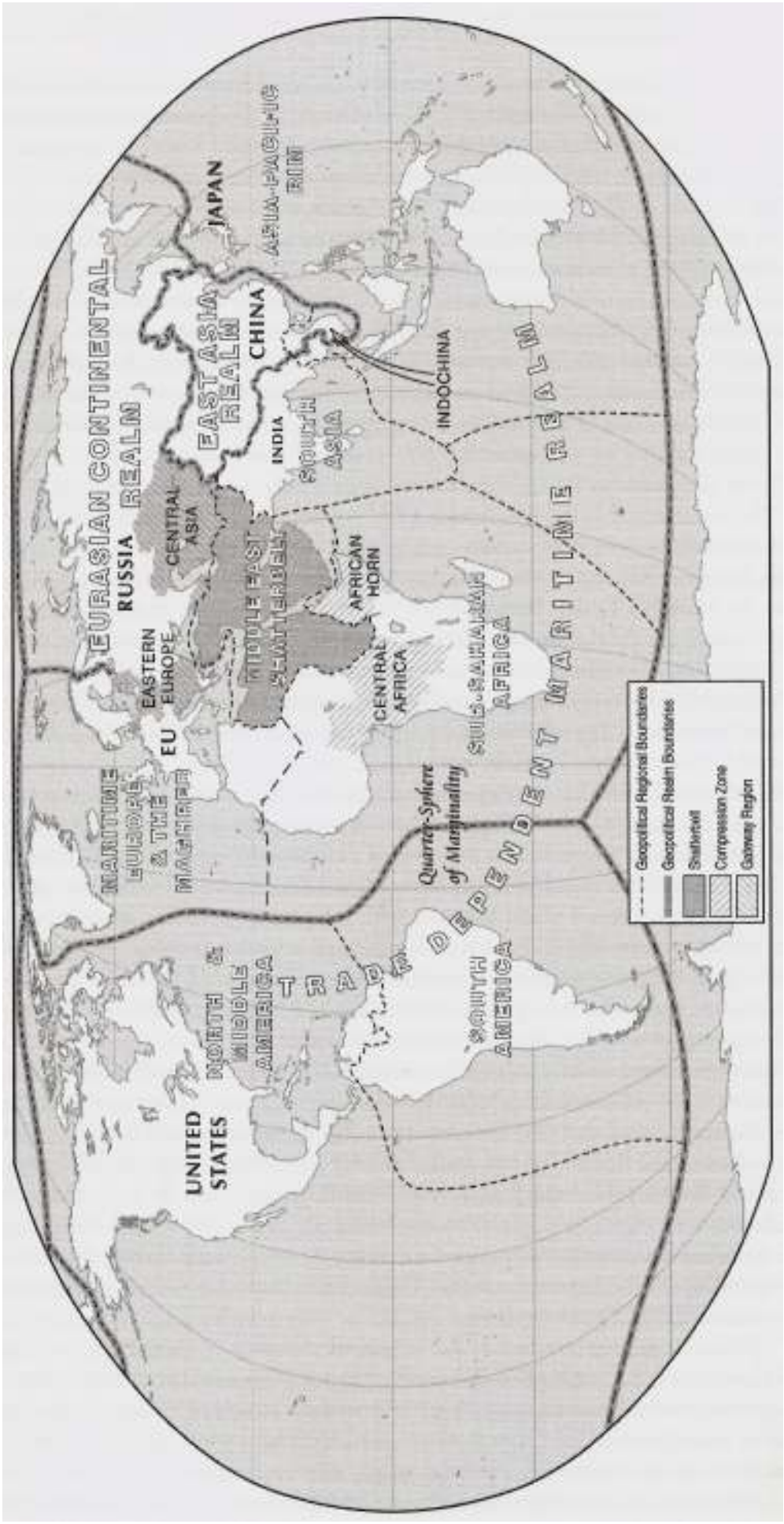


Figure 6-4 Samuel Huntington's 'Civilizations'
Source: S. Huntington 1997

Figure 6-5 Geopolitical World System Regions circa 2000 A.D.
(Next Page)

Source: Cohen 2003


EURASIAN CONTINENTAL
RUSSIA REALM
EASTERN EUROPE
EU
MARITIME EUROPE & THE MAGHREB
CENTRAL ASIA
MIDDLE EAST
SHATTERBELT
EAST ASIA REALM
JAPAN
CHINA
INDIA
SOUTH ASIA
INDOCHINA
AFRICAN HORN
CENTRAL AFRICA
SUB-SAHARAN AFRICA
Quarter-Sphere of Marginality
INDEPENDENT MARITIME REALM
NORTH & MIDDLE AMERICA
TRADE
SOUTH AMERICA
UNITED STATES
Geopolitical Regional Boundaries
Geopolitical Realm Boundaries
Shatterbelt
Compression Zone
Gateway Region

6.5.1 World regions and socioeconomic data

Crucially, these same divisions show up in other economic and social data. As noted in an earlier section, one of the factors driving the increase in econometric and comparative political economic research is the sharp increase in the quality and coverage of relevant datasets. These have been developed from careful sifting and assimilation of historical records (e.g., in Bairoch, Maddison, and Curtin) and for contemporary data on difficult-to measure social variables, from large-scale survey work. One example of the latter is the World Values Survey covering sixty five societies representing 75 percent of the world's population. The surveys cover a wide range of attitudes and beliefs on political, social and religious questions. Factor analysis of these scores by Inglehart (2000) revealed two axes of strong variation across countries. One axis, 'traditional/secular rational', relates to attitudes towards such areas as religion, family size, family ties, deference to authority, acceptance of military rule, and national pride. A second axis, 'survival/self expression', taps into the intergenerational shift from a traditional focus on security against 'increasing emphasis on self expression, subjective well-being, and quality of life' and attitudes towards such things as the environment and gender. These two primary dimensions of norms and values are plotted against each other in Figure 6-6.

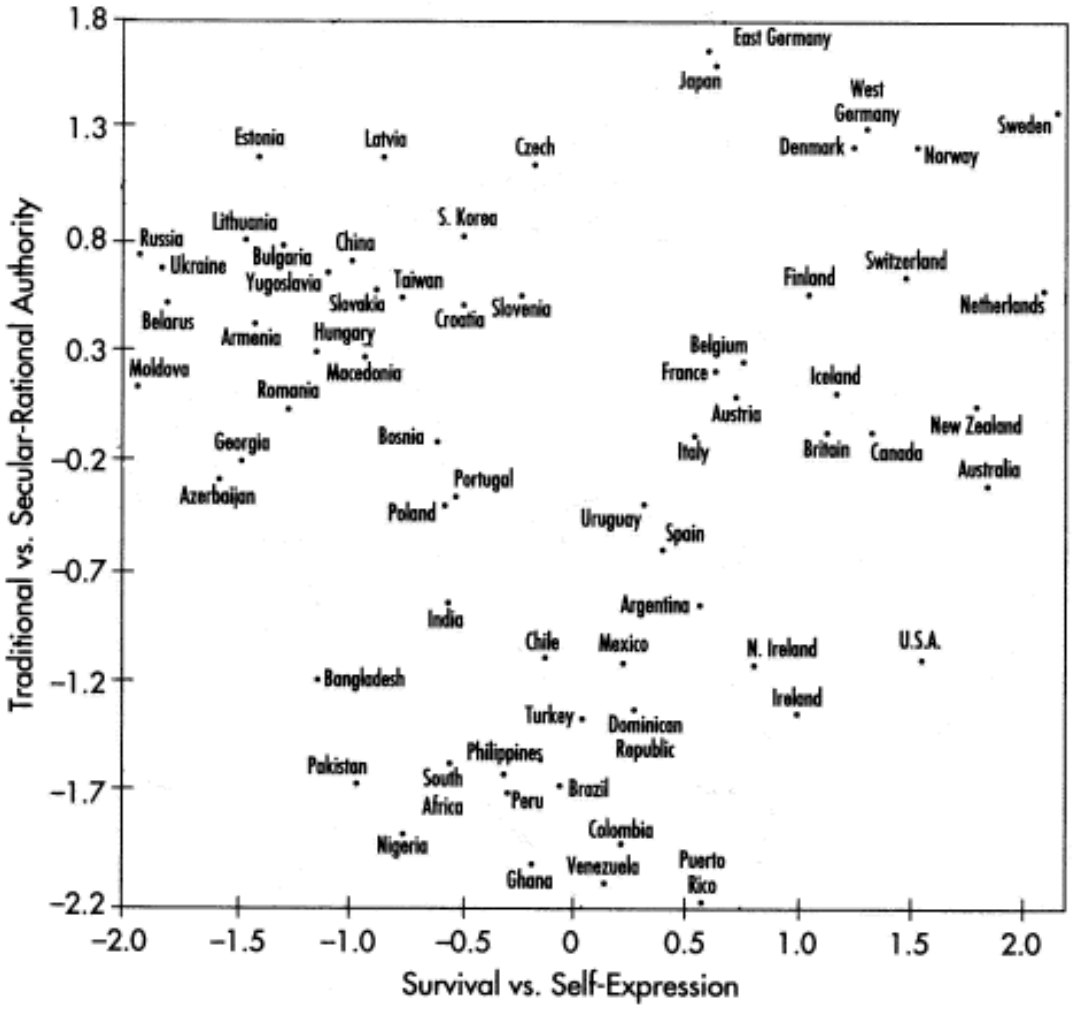


Figure 6-6 World Values Survey
Source: Inglehart 2000, 85

Figure 6-7 below shows the same figure, while overlaying a world-regional scheme, Samuel Huntington's 'civilizations', over the countries.

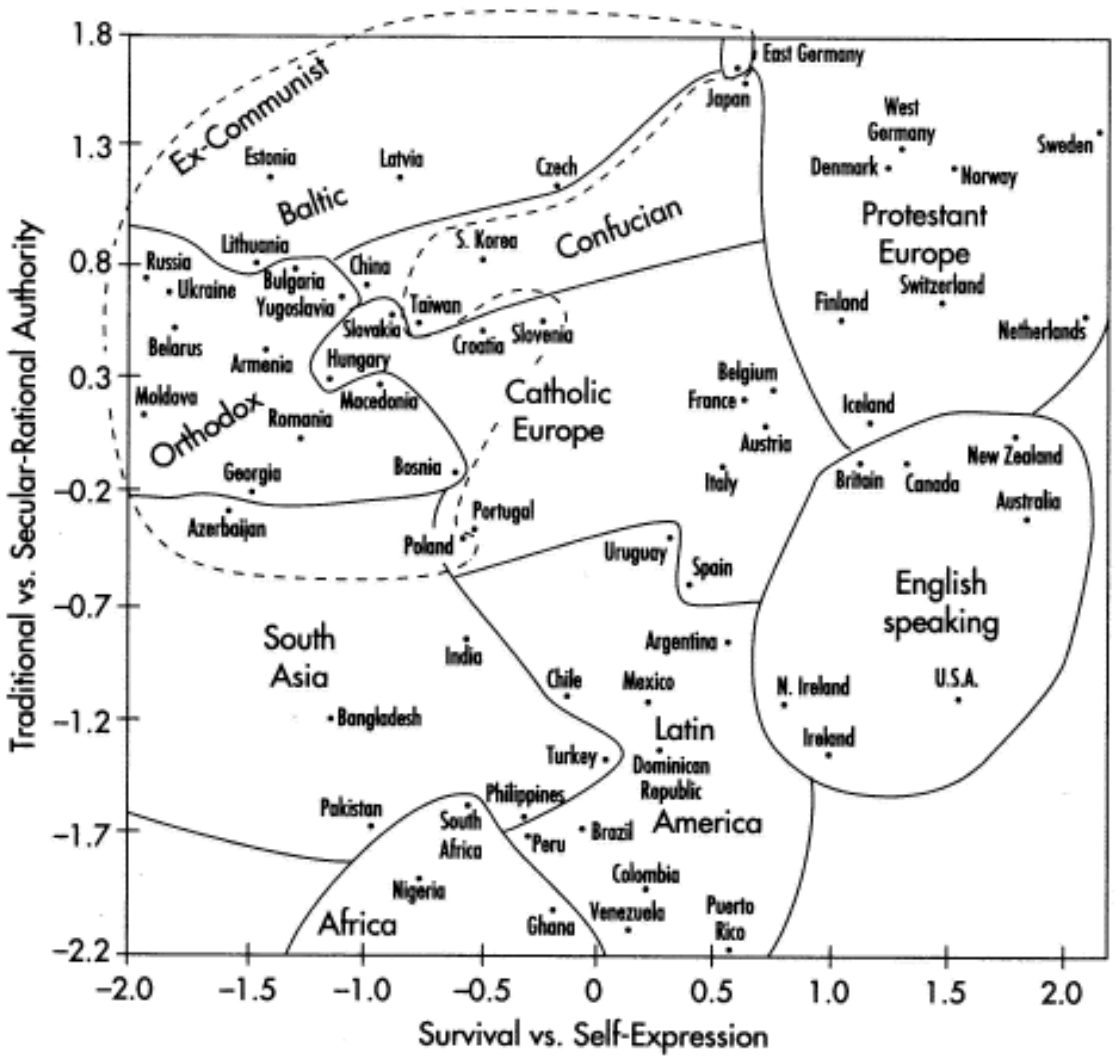


Figure 6-7 World Values and Civilizations
Source: Inglehart 2000, 85

It proves quite easy to group the data by historically internally-related, externally-separate world regions. Figure 6-8 below overlays isopleths based on GDP onto the same data, showing the close relation of GDP with the above social dimensions and world regions as well.

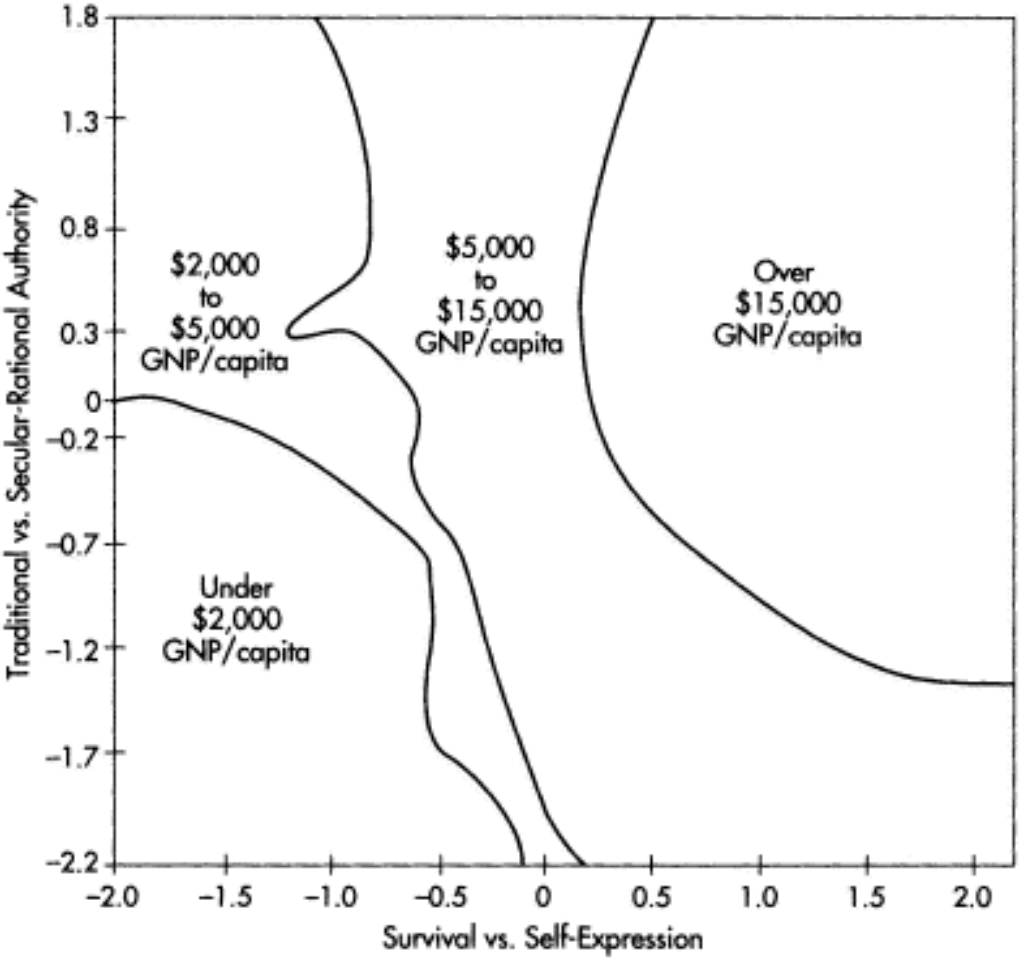


Figure 6-8 World Values and GDP
Source: Inglehart 2000, 89

Figure 6-7 helps illustrate that there seems to be similarities at the world regional level between countries on the norms and values that are captured by the World Values Survey, while Figure 6-8 suggests these are correlated with wealth.

Categorizing economies by GDP has been strongly criticized. A recent useful attempt is made by Hoeschele (2002) to divide countries into a more logical schema than 'third world' and 'least developed/developing/developed', and also to capture aspects not captured by GDP. He uses a detailed breakdown of industrial exports to develop a measure of industrial production (CMI) on one axis, and percent non-agricultural population (NAP) on another axis. Plotting countries on these axes gives a more nuanced measure of the type of economy countries have (Figure 6-9).

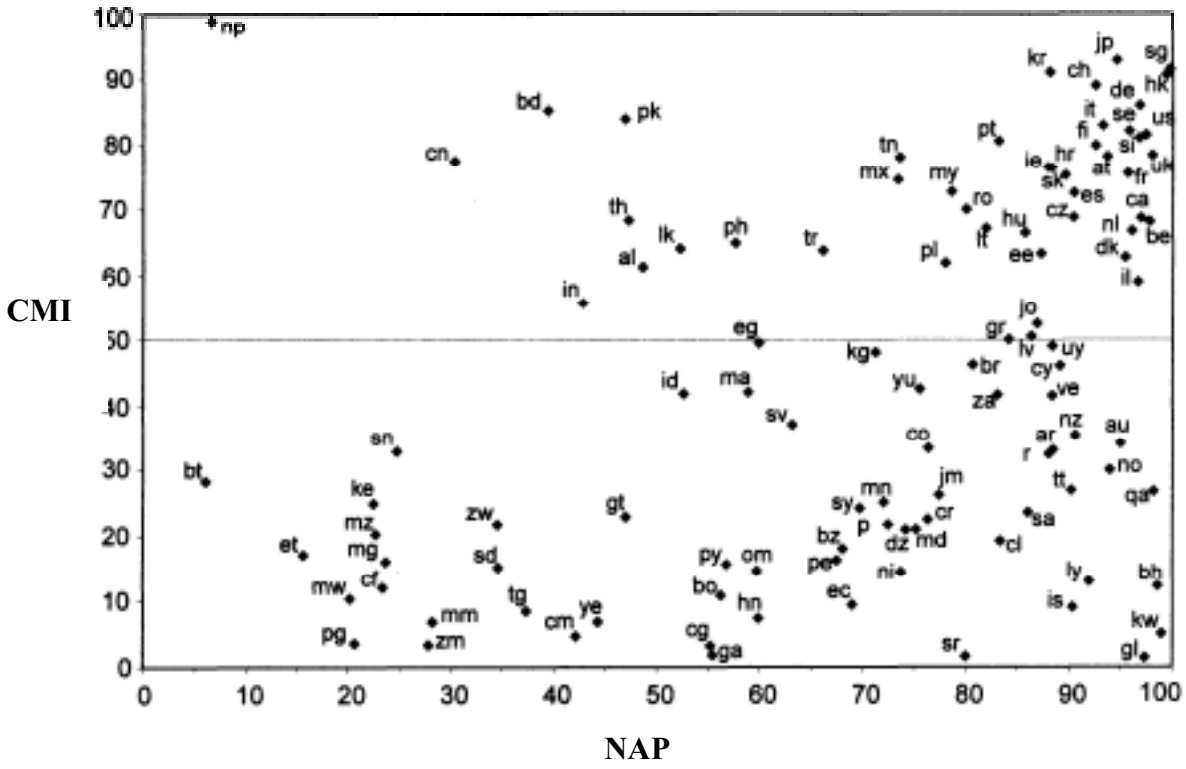


Figure 6-9 Census of Manufacturing Industries (CMI) & Percent of Non-Agricultural Population (NAP)

Source: Hoeschele 2002

Abbreviations (Internet domain names of countries)

al Albania
ar Argentina
at Austria
au Australia
bd Bangladesh
be Belgium
bh Bahrain
bo Bolivia
br Brazil
bt Bhutan
bz Belize
ca Canada
cf Central African Republic
cg Congo
ch Switzerland
cI Chile
cm Cameroon
cn China
co Colombia
cr Costa Rica
cy Cyprus
cz Czech Republic
de Germany
dk Denmark
dz Algeria
ec Ecuador
ee Estonia
eg Egypt
es Spain
et Ethiopia
fi Finland
fr France
ft Trinidad and Tobago
ga Gabon
gl Greenland
gr Greece
gt Guatemala
hk Hong Kong
hn Honduras
hr Croatia
hu Hungary
id Indonesia
ie Ireland
il Israel
in India
is Iceland
it Italy
It Lithuania
jm Jamaica
jo Jordan
jp Japan
ke Kenya
kg Kyrgyzstan
kr South Korea
kw Kuwait
lk Sri Lanka
lv Latvia
ly Libya
ma Morocco
md Moldova
mg Madagascar
mm Myanmar
mn Mongolia
mw Malawi
mx Mexico
my Malaysia
mz Mozambique
nI Netherlands
ni Nicaragua
no Norway
np Nepal
nz New Zealand
om Oman
pa Panama
pe Peru
pg Papua New Guinea
ph Philippines
pk Pakistan
pl Poland
pt Portugal
py Paraguay
qa Qatar
ro Romania
ru Russia
sa Saudi Arabia
sd Sudan
se Sweden
sg Singapore
si Slovenia
sk Slovakia
sn Senegal
sr Suriname
sv El Salvador
sy Syria
tg Togo
th Thailand
tn Tunisia
tr Turkey
uk United Kingdom
us United States
uy Uruguay
ye Venezuela
ye Yemen
yu Yugoslavia
za South Africa
zm Zambia
zw Zimbabwe

This data illustrates the degree to which countries are spatially autocorrelated on this more subtle categorization of economies. Figure 6-10 shows the same data grouped by world region (with the exception of group D):

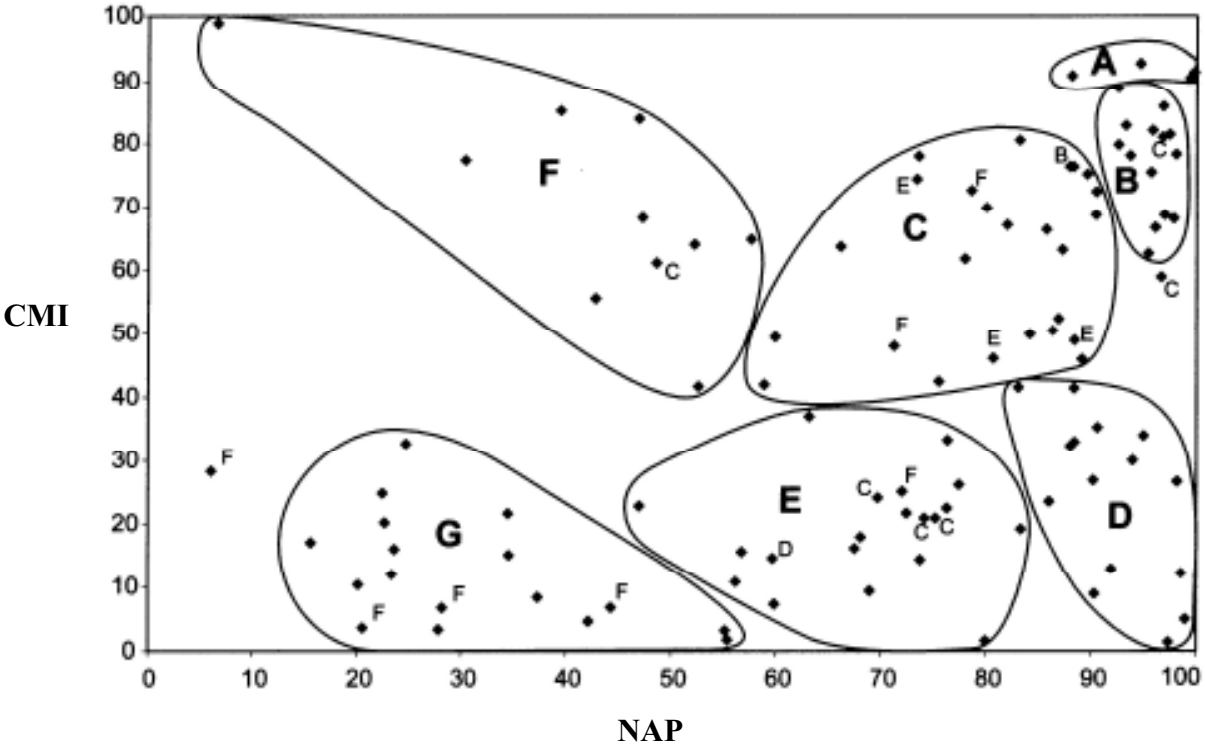


Figure 6-10 CMI/NAP by Regions
Source: Hoeschele 2003

The seven clusters outlined are A: Japan, Korea, Hong Kong and Singapore; B: most of Western Europe, the United States and Canada; C: Eastern Europe and the Mediterranean, D: wealthy to semi-wealthy natural resource intensive countries, such as Australia, New Zealand, Argentina, Iceland, Greenland, Norway, South Africa, and Russia; E: Latin American Countries, F: Central and South Asian economies with manufacturing exports i.e. China, Bangladesh, Nepal, Pakistan, Thailand, India; and G: Sub-Saharan African countries.

These examples demonstrate the degree to which economic and cultural data vary between historically known areas of non-independence, with the greatest variation being *between* these areas, not within them. Critically, this vividly illustrates how few substantially independent development trajectories there are (especially at the scale of *substantial* variation in socioeconomic measures) and the degree to which it is likely that most econometric development studies suffer from Type-I errors in analysis.

6.6 World Regions and the 'Simple Environmental Determinism' Objection to Explanation from Initial Conditions

In addition to the moral objection to determinism discussed in Chapter 4, another primary objection to determinism and explanation from 'ultimate' causes is that it is overly *simplistic*. As noted in Chapter 2, a primary motivation for both Bhaskar and Cartwright in developing an alternative to explanation based on regularity accounts of causation was that these could not account for the messy complexity of the universe. One objection to this criticism is that it is in a way tantamount to rejecting explanations based on emergence (explaining complex outcomes from simple beginnings), when many view emergence as the single most important explanatory goal of the special sciences.[102] We will return to this problem in the conclusion of the dissertation. Another objection to the criticism that 'deterministic' explanations relying on simple geographic factors are wrong, however, is directly related to the fact that as discussed in the previous section there are very few regions with substantial variation.

Simple explanandum

One problem with the simplicity critique of the use of geographic factors in explanation is that, in some ways, regarding uneven development the *explanandum itself is simplistic*, at least concerning the large-scale spatial patterns of development. It should not be surprising that the explanans, then, are also to some extent simple.

What is meant by saying the explanandum is simple? How can the result of such an incredibly complicated set of interactions that characterizes the development of complex societies and their economies be *simple*? Basically, as discussed in the previous section, although the social processes involved are incredibly complex, at the scale that most econometric studies are concerned with the variation between spatial distributions are large and few in number. Writers of every political persuasion and discipline have, despite otherwise very different views, divided the world into the wealthy developed countries, the poorest countries (Sub-Saharan countries,

[102] For example, Bonta and Protevi state they believe emergence to be 'the biggest question in social science, implicated as it is in all the controversies surrounding methodological individualism, the structure/agency debate, Luhmann's differentiation of systems, and so on.' (Bonta and Protevi 2004, 32).

Bangladesh) and the in-between countries (the 'Second World' of communist countries, sometimes Latin America, etc.). One can add a few more divisions, but overall these classifications, and equally important, their spatial delineation, are broadly similar. This is evident in the various classifications and maps in the previous section from geographers, historians, anthropologists, and economists. Other more sophisticated and historically sensitive divisions still divide the *spatial* pattern into the same simple pattern. For example, the 'world systems' approach associated with Wallerstein (1974, 1980, 1989) divides the world into an industrialized core region, a non-industrial periphery, with some in-between areas being classified as semi-peripheries. Despite differences in emphasis and analytical considerations, the basic spatial delineation is virtually the same as that in the common 'first, second, and third world' division. (Cohen's illustration, Figure 6.5, provides an example. Peter Taylor was a central figure in introducing world systems analysis into geography [1981a, 1981b, 1982, 1986, 1991]).

Another sophisticated and historically grounded classification system is that of Menzel and Senghaas. They divide the world by using the historical influence of collective actors on subsequent institutional and economic development (Table 6-3).

	Decisive collective actors				Social compromise resulting from the formative conflict
Type	Farmers	Bourgeoisie	Workers	State Bureaucracy	
1. No feudal past	Freehold farmers	Productive small business sector	Wage earners gain strength early	Pursues a coherent development strategy: infrastructure construction, selective protectionism	Autocentric virtuous circle. ***Examples:*** **The four settler colonies: Canada, the U.S., Australia, New Zealand**
2. Successful defeudalization	Similar structure as Type 1, but as a result of often long and painful processes of social change depending on the variable configuration between rulers, aristocracy, merchant capital, bourgeoisie, working class.				Autocentric virtuous circle. ***Examples:*** **Western Europe,** particularly smooth in Scandinavia.
3. Dominant agrarian oligarchy and merchant capital	Agrarian oligarchy	Strong merchant capital fraction, a subordinate industrial bourgeoisie			Vicious circle of peripheral export economies. ***Examples:*** **Latin America, peripheral Europe**.
4. Colonial situation				Local elites retaining – after independence – privileges gained in collaboration with colonial rulers.	Vicious circle of peripheral export economies, perhaps even more monocultural enclave economies than Type 3. ***Examples:*** **Many third world countries**.
5. State class				State class may succeed in dominating traditional forces, embarking on an offensive development strategy	Different outcomes in individual countries. ***Examples:*** **The Southeast Asian NICs.**

Table 6-3 'Comparative Typologies of Development Patterns'
Note that despite the complex and subtle interconnections between social factors considered, the resulting regions in the far right column are essentially the same as the divisions discussed in Section 6.5, and *spatially* quite simple.

Source: Menzel and Senghaas 1986 from Mjøset 1993, p. 42

Note that again, despite the complex and subtle interconnections between social factors considered, the resulting regions in the far right column are essentially the same as the divisions discussed in Section 6.5, and spatially quite simple. Even in analyses that eschew many of the assumptions of mainstream economics or other orthodox approaches to international development use the regions discussed in

Section 6.5. For example, Bayart, in 'Finishing with the Concept of the Third World: The Concept of the Political Trajectory' (1991), argues that the many development experiences in the world must be treated more subtly, each constituting, following the linguist Mikhaïl Bakhtin, its own 'discursive genre' that makes even the attempt at defining and comparing regions suspect. He argues that, for example, the study of the sub-Saharan postcolonial state includes discursive genres such as the French Jacobin state model, the British system of government, Soviet, North Korean, and Chinese models, American Federalism, Islamic, Protestant, and Catholic categories, indigenous categories of royal or lineage power, and 'worlds of invisible prophecy'.

It is surely true that these discursive genres, and the fact that all of them have influenced the political development of postcolonial sub-Saharan Africa, demonstrate the incredible complexity of discussions of political-economic development (or any of the social sciences). However, the *spatial* forms of Bayart's 'genres' (i.e., European influence on state formation, communist states, world distributions of religion) nevertheless take on the relatively simple patterns shown in Section 6.5 at the global scale where the questions of uneven development are often posed (see also Appendix C). Furthermore, as Inglehart (2000, see figure 6.7) and related work increasingly demonstrates, the subtle aspects of belief in the supernatural and other sociocultural beliefs and habits Bayart alludes to, when measured, show world regional divisions related to such diverse factors as attitudes towards religion, family size, family ties, deference to authority, acceptance of military rule, national pride, and attitudes towards such things as the environment and gender all to robustly support world regional divisions such as those by Lewis and Wigen.

The consistency across time periods and points of view of the spatial divisions between rich and poor, developed and undeveloped, first, second and third world nations, supports the robustness of these divisions. The relatively clear and simple spatial divisions, despite the underlying complexity of social processes, suggest that the spatial explanation needed to overcome the problem of circular endogeneity may be tractable.

6.7 Summary

The fact that the answers to development have always *seemed* just within reach due to the robust correlation between geographic, institutional and economic factors is

likely part of what drives the huge amount of literature on development, and caused uneven development to emerge early as one of the central questions that would spur the development of the 'social sciences'. Whether Montesquieu's geographic explanations, Weber's cultural explanations, or dependency theories of development, all have proven convincing to some at first blush because these simple answers do indeed fit much of the data. The problem, it turns out, is not that none, but that *all* fit the data. Their spatial *simplicity*, not complexity, is a large part of the reason why centuries after Smith and Montesquieu they are still not resolved.

This chapter has been concerned with some of the problems with common methods of studying uneven development, and some alternative methods that, while not perfect, help bring to light some of these problems and potentially are better able to convey information relevant to understanding uneven development.

Three primary problems discussed are the lack of fit of statistical methods to the questions of most interest to laypersons and scholars alike concerning uneven development, the problem of spatial autocorrelation (as a problem of initial and boundary conditions as discussed in Chapter 2), and the problem of 'apparent populations' and a statistical approach to unique, non-repeatable outcomes such as development. In contrast to these, spatial visualization of data is often superior because it fits the data, fits the questions asked, and fits human cognition.

CHAPTER 7
INITIAL CONDITIONS AND THE 'INSTITUTIONS VERSUS GEOGRAPHY' DEBATE

7.1 Introduction

The previous chapter considered problems with current approaches to the study of uneven development and some theoretical reasons why visual methods may be useful in resolving these. This chapter considers this discussion in the more concrete context of uneven development. We consider a widely cited series of papers by Acemoglu, Johnson and Robinson (hereafter 'AJR') that address important arguments related to institutions and geography within the ongoing debate concerning uneven development.

As noted in Chapter 1, the failure by economists and others dealing with questions concerning uneven development to develop widely accepted explanations for development differences (and especially, the fact that these differences clearly do not match the predictions of convergence of neoclassical growth theories) led to the search for new factors. However, as more factors were considered the paradox of circular endogeneity became evident. This has led to increased attention to initial conditions, including geographic factors.

What has happened, however, is that more and better data has shown ever more convincingly that of three major categories of factors – social and development indicators, institutions, and geographic factors - all *three* vary closely, to an unusually robust degree by social science standards (Bloom and Sachs 1998; Hall and Jones 1999; La Porta et. al. 1999; Easterly and Levine 2002; Rodrik et. al. 2002; Warner 2002). This close covariation among factors leaves open virtually all of the possible causal interpretations and presents a problem for understanding and explanation. This general problem might be diagrammed in the following way (with Institutions as 'I', Geography as 'G', and Development as 'D'):

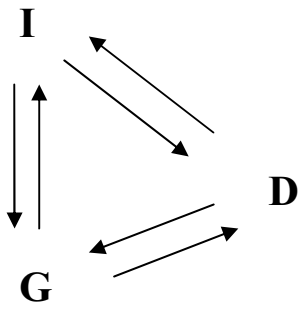


Figure 7-1 Possible Causal Relations between Institutions, Geography, and Development

However, we can imagine that human institutions and development in the past did not usually significantly change geography.[103] Eliminating these causal relations leaves the causal possibilities like this:

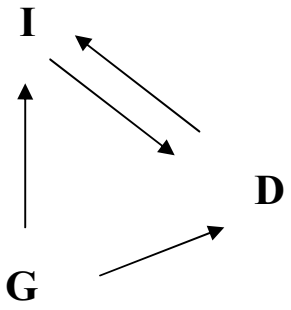


Figure 7-2 Reverse Causality between Institutions and Development

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[103] This is not to say that economic development (or institutional characteristics) never had impacts on geography. Obviously institutions or development had no effect on some things, such as the location of mineral deposits, the relative positions of the continents, and wind and ocean currents. Other things, however, *were* affected by human activity, sometimes to such a degree that the changed geography in turn affected humans, and thus the 'geographic' influence can be attributed to human actions. This is most notable, perhaps, with resource depletion and degradation, especially deforestation and salinization in some areas. Overall, in the time periods that economists consider there was *relatively* little human-induced environmental impact; historic human induced geographic change has seldom been on the scale seen with modern population levels and with post-industrial revolution levels of technology.

Furthermore, historically, there was little *knowledge* of human influence on environmental change - little understanding of collective action, no germ theory of disease, no large-scale international record keeping, little long-term and relevant record keeping. For all practical purposes, the gradual yearly decrease and eventual demise of crops in a region of salinization, for example, would have seemed as much an act of nature (or the Gods) to an ancient society as an earthquake or hurricane. If only because of their ignorance of its causes, most human-caused environmental change was as unavoidable as non-human caused environmental distributions and occurrences, and just as equally shaped by still earlier geographically varying factors (the relationship between the social and environment is clearly *not* a 'chicken or egg' type problem: An environment *always* predates any given period one is examining. Thus even if we consider, for example, human-induced feedback on the environment by salinization, the distribution of soils susceptible to salinization and amenable to irrigation, the biogeography of the crops available and adopted by that society and so on all predate the human induced change).

However, Figure 7.2 is still unsatisfying. Institutional theories of development emphasize the link between institutions and development while geographic theories, not only older theories but recent theories (e.g., Gallup, Sachs, and Mellinger 1999 and similar works) between geography and development. (Other possibilities, not shown, are clear from the diagram however. One, of course, is that geography causes institutional changes that then affect development. Figure 5.1 illustrates a number of possibilities).

For the present discussion, two other obvious possibilities are especially important; they are addressed by AJR, who develop ingenious methods to attempt to test possible links. The first, AJR 2001, attempts to rule out the possibility of *reverse causality* between development and institutions. As shown in Figure 7-2, rather than institutions causing better development outcomes, it could be that development allows for society to develop and maintain, to 'buy', better institutions. AJR 2001 argues that this is not the case, which would leave the diagram looking like this:

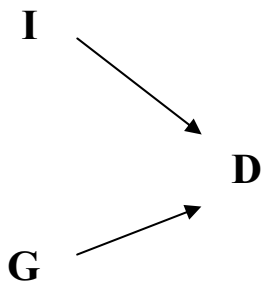

Figure 7-3 'Geography' or 'Institutions'?

Maybe geography does have some direct effect on development (McArthur and Sachs 2001), and it seems that institutions do as well (La Porta 1999, Rodrik et. al. 2002). But which is the more *important* of the two? This is the question the *second* AJR paper, AJR 2002, seeks to answer.

7.2 Recent Background of the Debate

Although these types of development questions are of course older than the social sciences themselves, an important paper that in part helped stimulate the revival of attention to these questions is Engerman and Sokoloff (1994). They sought to understand the development divide in the Americas. Why are Central and South

America substantially poorer than North America? The Americas seem to present an interesting case. On the face of it, both North and South America offered tremendous material wealth, as well as vast new territories for development by Europeans. Why would one become extremely materially wealthy by world standards, while the other has remained relatively less developed? This question is especially interesting given the seldom recognized fact that many of the areas of Central and South America that are today less developed were significantly *wealthier* - after colonization until the nineteenth century - than Canada and the United States (Engerman and Sokoloff 1994).

The Engerman and Sokoloff article comes to the conclusion that it is the variation in means of production – the variation in types of agricultural regimes - that has the greatest explanatory power. The variation in these regimes is in turn a result of the underlying spatial distribution of soil and climate. Theirs is a relatively straightforward explanation. The patterns of types of agriculture in a region were conducive to patterns of agricultural systems. These in turn had profound and lasting effects on patterns of institutions, which have endured to this day, with concomitant patterns of development associated with those types of institutions.

AJR, in their first paper, build on this idea. However, their mechanism is slightly more complex. Rather than replacing the Engerman Sokoloff view, AJR add another layer of complexity to it. They do not just see a straightforward path from 'good' agriculture to good institutions and development, and from 'bad' agriculture to bad institutions to less development. They argue for what they call 'extractive regimes', where a number of factors can cause extractive regimes made up by a small elite class dedicated to extracting wealth from a region (see Section 5.4 for additional description of their argument). These may form, as Engerman and Sokoloff argued, in areas conducive to high return-to-scale plantation agriculture, which tended to be the coastal regions, especially the sugar growing regions. Extractive regimes also formed, however, for the same reasons, in areas dominated by mining and especially in areas where there were relatively large numbers of colonized peoples and small numbers of settlers due to different mortality rates due to differences in resistance to diseases. Thus the pattern did not just depend on patterns of high return-to-scale agriculture, but also was the result of the interplay between areas of high settler mortality (the biogeography of disease) and high initial populations (such as the Incan and Aztec

empire). In areas where a small percentage of the population controlled a large colonized population, governance was virtually guaranteed to be extractive and elite.

Like Engerman and Sokoloff, they also see institutions as enduring.[104] Even when the colonized masses overthrew the colonial elite, the elite institutions endured, with long-term development consequences.

7.2.1 Instruments and natural experiments

Before we consider the relationship of AJR 2002 and Figure 7.3 (the attempt to weigh the importance of geography versus institutions), consider AJR 2001 and Figure 7.2 and the attempt to resolve the problem of reverse causality between institutions and development, to find out whether modern wealth is simply 'buying' good institutions. AJR 2001 develops an ingenious dataset for testing the problem of reverse causality in Figure 7-2. The dataset uses historical records of settler mortality, derived from military and missionary records. They are then able to regress this data against institutional and development data. There is no clear way in which modern development differences could cause high settler mortality centuries ago. So if there is a high correlation among settler mortality and modern institutions, it suggests that the extractive regimes that were set up in areas of high settler mortality were the cause of institutional patterns, rather than institutional patterns being 'bought' by later development.

Another Natural Experiment: Institutions versus Geography

Another obvious question concerning causal connections is apparent in Figure 7-3. There is strong evidence (that is, robust correlations between the best data *and* known mechanisms of influence that potentially account for the correlations) that both geography and institutions have *some* effect on development. But which is the more *important*? (McArthur and Sachs 2001; Rodrik et. al. 2002). The increasingly clear covariation between both geography and development and institutions and

---

[104] This is a very important point for their argument; note their view from economics is strongly supported by geographer Ron Martin. 'By their very nature institutions are characterized by inertia and durability – these are precisely the features that provide the structured frameworks necessary for the coordination and continuity of economic activity…Institutions are characterized by "path dependence," that is they tend to evolve incrementally in a self-reproducing and continuity preserving way' and 'institutions are therefore important "carriers of history"' (Martin 2000a, 80).

development has led to what some have termed an 'institutions versus geography' debate in recent years.

To consider this question, AJR (2002) again develop an ingenious new dataset of historical development indicators. And again they use this to view colonization as a natural experiment.

The dataset they develop is designed to test the level of development in 1500. This can then be regressed against current levels of development and institutional factors. Acemoglu (2003) explains:

> To make progress in understanding the relative roles of geographic and institutional factors, we need to find a source of exogenous variation in institutions—in other words, a natural experiment where institutions change for reasons unrelated to potential omitted factors (and geographic factors remain constant, as they almost always do).
>
> The colonization of much of the globe by Europeans starting in the fifteenth century provides such a natural experiment. The colonization experience transformed the institutions in many lands conquered or controlled by Europeans but, by and large, had no effect on their geographies. Therefore, if geography is the key factor determining the economic potential of an area or a country, the places that were rich before the arrival of the Europeans should have remained rich after the colonization experience and, in fact, should still be rich today. In other words, since the key determinant of prosperity remains the same, we should see a high degree of persistence in economic outcomes. If, on the other hand, it is institutions that are central, then those places where good institutions were introduced or developed should be richer than those in which Europeans introduced or maintained extractive institutions to plunder resources or exploit the non-European population. (Acemoglu 2003, 27-28)

AJR 2002 finds that there was a 'reversal of fortune', and conclude that this shows the greater importance of institutions vis-à-vis geography:

> So what happened to economic development after colonization? Did places that were rich before colonization remain rich, as suggested by the geography hypothesis? Or did economic fortunes change systematically as a result of the

> changes in institutions? The historical evidence shows no evidence of the persistence suggested by the geography hypothesis. On the contrary, there is a remarkable *reversal of fortune* in economic prosperity.
>
> Is the reversal of fortune consistent with the institutions hypothesis? The answer is yes. (Acemoglu 2003, 28)

There have been numerous responses and criticisms of AJR's arguments. But most of these have largely still been based on regression techniques. Considering their argument in relation to relevant mapped data and in a simple tabular form we believe helps show some important relations in their data, better than regressions do, as well as making clear a fundamental flaw in the AJR 2002 argument that institutions 'trump' geography in explaining development outcomes.

As discussed in Chapter 6, one important potential problem with statistical comparisons is with spatial autocorrelation. Based on the historically known close trade, linguistic, religious and other connections within world regions (but not between them), there are good reasons to doubt that individual countries represent substantially independent development trajectories. With this in mind, one way to re-consider the AJR data is to break the data into world regions. In Table 7-1 we divide their cases (former colonies) by the world regions discussed in Chapter 6 (we further subdivide 'Latin America' based on the degree to which the pre-Colombian peoples influenced post-colonial countries). The data within each column is further divided into three columns representing the degree of settler mortality (over 200 per 1,000 settlers, between 200 and 50, and less than 50; AJR 2001) and into five rows representing categories of Gross National Income (Low, Medium-Low, Medium, Medium-High, and High). Below each case is a number representing the data on urbanization in 1500 (AJR 2002) which AJR used as a proxy for development in 1500.

Table 7-1 Settler Mortality, Urbanization, and Gross National Income
(Next Page)

Settler Mortality →		Sub-Saharan Africa			Aztec and *Inca*			Other Latin America			South/East Asia			N. Africa/Mid East			Settler Colonies		
		Hi S.M. 201+	**Med 200-50**	**Low 50-0**	**H**	**Med 200-50**	**L**	**Hi 201 +**	**Med 200-50**	**Low 50-0**	**Hi 201 +**	**Med 200-50**	**Low 50-0**	**H**	**Med 200-50**	**Low 50-0**	**H**	**Med 200-50**	**Low 50-0**
Low GNI		Sierra Leone <3.2 Congo <3.2 Madagascar <3.2 Niger <3.2 Mali <3.2 Nigeria <3.2 Burkina Faso <3.2 Uganda <3.2 Zaire <3.2 Togo <3.2	Senega l <3.2						Haiti 3.0							Ethiopia			
Med-Low GNI		Angola <3.2 Côte d'Ivoire <3.2 Gambia <3.2 Ghana <3.2	Sudan <3.2			*Bolivia 10.6* *Ecuador 10.6* Guatemala 9.2 Honduras 9.2 Nicaragua			Jamaica 3.0	Guyana 0.0		Indonesia 7.3 Pakistan 8.5 Vietnam 7.3 India 8.5	Bangladesh 8.5 Sri Lanka 8.5		Egypt 14.6 Morocco 17.8				
Med GNI						*Colombia 7.9* Panama El Salvador *Peru 10.5*			Dominican Republic 3.0 Paraguay 0.0 Venezuela 0.0						Algeria 14.0				
Med-High GNI				South Africa <3.2		Costa Rica 9.2 Mexico 14.8			Bahamas Brazil 0.0 Chile 0.0 Trinidad and Tobago				Malaysia 7.3			Tunisia 12.3		Argentina 0.0 Uruguay 0.0	
High GNI												Hong Kong 3.0	Singapore 3.0						Australia 0.0 New Zealand 3.0 Canada 0.0 U.S.A. 0.0

One of the first things one notices is that there is indeed strong clustering by regions in the data on all measures. Spatial autocorrelation appears to be substantial, with nearby countries with shared historical relations, language, religion, and colonial history grouping together. Significance tests relying on this data using each country as an independent unit of data are likely inflated because the positive spatial autocorrelation in the data leads to a strong case of Type-I error.

The data do seem to support the relationship between high settler mortality and later high measures on institutional measures. Sub-Saharan Africa, with its incredibly high settler mortality, ranks at the very bottom of institutional and economic measures. Most Latin American, South and East Asian, and Middle Eastern countries rank in the middle on all of these measures, while the relatively small number of areas with low settler mortality rank high on institutional and economic measures. (Interesting outliers include South Africa, Ethiopia, and Singapore.)

However, the table also immediately makes obvious one major flaw with AJR 2002. AJR do not include the sub-Saharan African countries in their reversal analysis (although they do include it in their 2001 settler mortality-extractive regimes analysis). They justify this on the grounds that they did not have good data on sub-Saharan African urbanization in 1500. However, there is sufficient data on the historical demographic trends in Africa and later urbanization levels to make a reasonable estimate of the upper bounds of possible urbanization.[105] Including this data makes clear that it would ruin any *statistical* argument for a reversal of fortune. There are sixteen sub-Saharan countries with very little urbanization in 1500 A.D., and today these are among the poorest in the world. (Thus sixteen cases, all strongly counter to their hypothesis, added to an original dataset of only 41 cases [former colonies excluding Sub-Saharan Africa] in AJR 2002). They show nothing like the 'reversal' that AJR argued was seen by other unurbanized areas that later became wealthy. Although their omission might be noticed with a careful reading of their study (although not by looking at the statistical summary alone), it is far more noticeable in a simple tabular analysis of their result where blank cells are readily

[105] Andrew Clark notes that '[u]rban centers in precolonial Africa were relatively rare and small in population' (Clark 2006, 1290; see Coquery-Vidrovitch 2005 for detailed discussion); Bairoch (1988) estimates urbanization in sub-Saharan Africa by 1900 at 3.2 percent. Table 7.1 uses this figure as an upper limit for precolonial sub-Saharan regions.

apparent (Shalev 1998, 7 also emphasizes that the problem 'blank cells' pose for multiple regression is serious yet often ignored).

Tabular analysis is of course only one way of visualizing data. With data in general, but especially when the questions considered are *inherently* spatial (such as uneven development), maps are useful, yet frequently receive little analytical attention. Here considering mapped data helps make obvious a still more fundamental flaw in the AJR data that has not been pointed out in any of the literature.

7.2.2 A natural experiment?

Figure 7-4 is a cartogram depicting countries with each country rescaled in proportion to its population in 1500 A.D. and 2000 A.D. In many regions of the world, although total population growth has been dramatic, it has occurred to some degree uniformly, and thus the *relative* populations between many countries and regions at 1500 A.D. and 2000 A.D. have remained roughly similar (e.g., those of India, China, Europe, Japan, and Mexico). However, in several regions of the world there were dramatic gains in relative world population, particularly in North America (north of Mexico) and the southern cone of South America, and less noticeably in Australia, New Zealand and the southern cone of Africa.

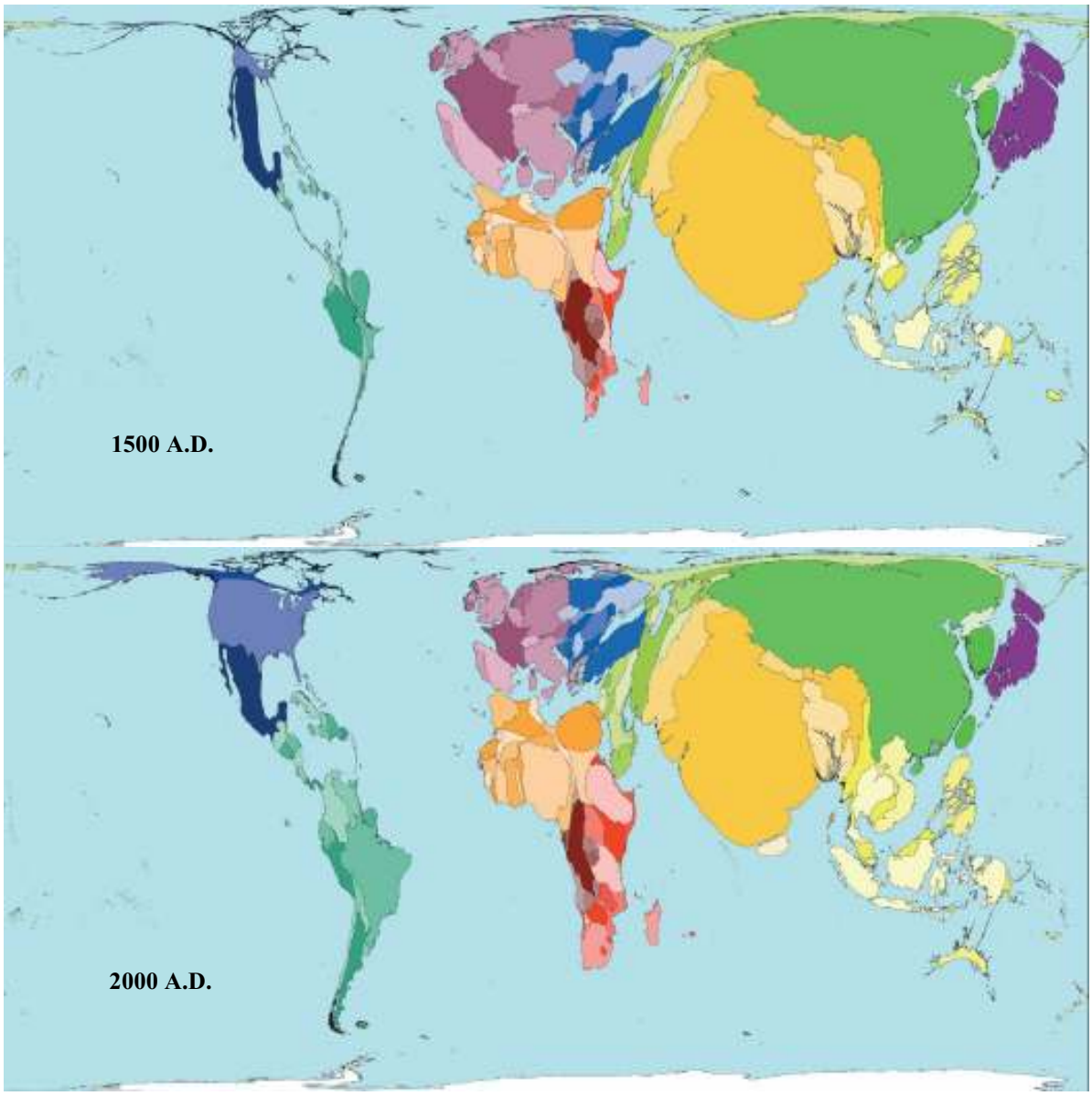

Figure 7-4 Cartogram Depicting Relative Population by Country, 1500 A.D. and 2000 A.D.
Source: Social and Spatial Inequalities (SASI) Research Group

The reason that those particular areas have grown in relative population is that they went from areas with virtually no food producing crops and animals in 1500 to almost overnight becoming overrun with a bewildering variety of many of the most productive food crops and livestock in the world (dramatically raising food production potential; on the relationship between net primary productivity and population density, see Luck 2007). It is known that the non-Eurasian temperate regions of the world were indeed some of the *least* hospitable to humans prior to the

infusion of temperate Eurasian biota. There simply were virtually no widespread, large-scale agricultural crops in these regions, nor widespread domesticable animals (These areas had virtually no food producing biota compared to Afro-Eurasia [and even fewer than the non-temperate populated regions of the Aztec and Inca with their limited but productive suite of crops]. Also, compare regions where there were highly productive crops, such as maize or potatoes, but in isolation from other suites of food producing biota; as would be expected, these areas had far smaller populations than similar Eurasian regions, yet far greater populations than the areas that had [virtually] *no* food producing biota. Also, note that the New World regions with virtually no food producing biota were nevertheless, temperate, and thus most easily received the vast array of Eurasian temperate food producing biota, Crosby 1972, 1986; also see Appendix D). Other maps show the dramatic change that would occur in these regions. The non-Eurasian temperate zones, with post 1500 AD introduction of Eurasian livestock, became and remain the world leaders in the production of livestock (Figure 7-5):

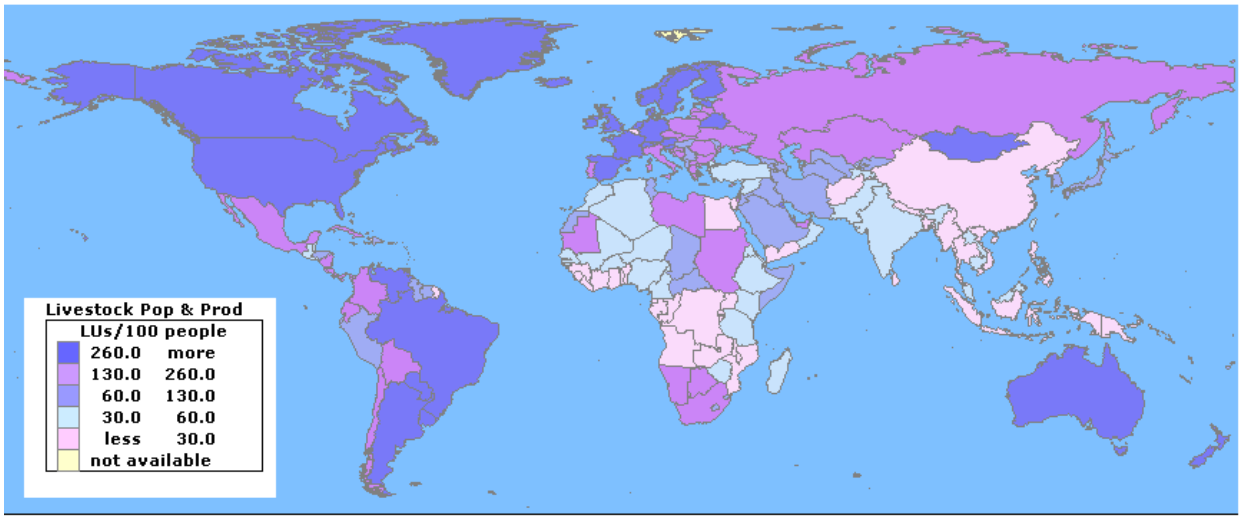

Figure 7-5 Global Livestock Production
Source: Global Livestock Production and Health Atlas (GLiPHA)

The most advanced (being based on combined global, yet extremely small scale [thousands of observations at 1 degree by 1 degree scales or smaller] data on numerous factors such as precipitation, evapotranspiration, frost days, terrains slopes, soil depth, soil fertility, soil chemistry, soil drainage, and soil texture) show that the temperate New World regions (e.g., East/Central North America, Uruguay,

Argentina) are some of the most potentially productive in the world (Figure 7-6; note that some areas, but especially the tropical areas of South America and Africa, are limited in production due to forest cover[106]):

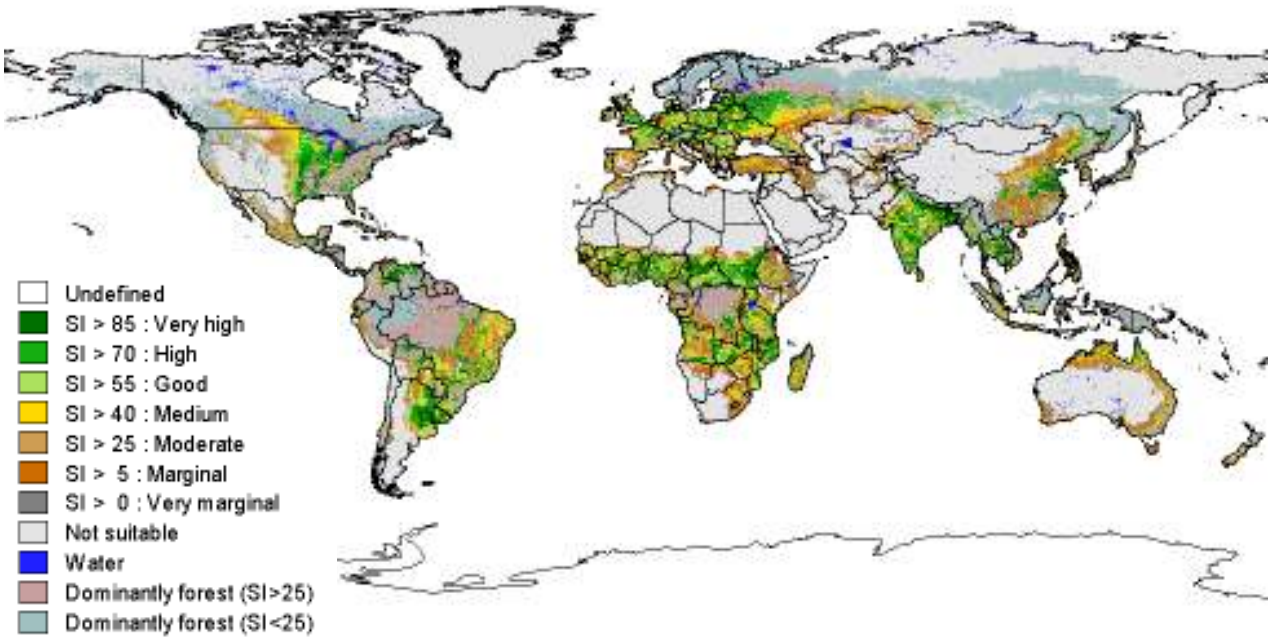

Figure 7-6 Global Suitability for Rainfed Crops
Source: Global Agro-Ecological Zones (GAEZ), 2000 - Food and Agriculture Organization of the United Nations (FAO) with the International Institute for Applied Systems Analysis (IIASA)

The potential for food production is not just theoretical – the incredible food production of Canada, the United States, Uruguay, and Argentina is well documented throughout the histories of these regions, as well as the incredibly high (historically unparalleled) natural population increase in these regions (Crosby 1986), where families with ten or more children, all surviving and well-fed, was not uncommon over many generations. The inherent suitability for food production – both for Eurasian animal and plants which allowed for previously unimaginable rates of natural increase, and today - is still reflected in the incredible surpluses of these regions. These regions today quite literally feed the world (Figure 7-7):

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[106] This data is calculated for a number of Eurasian staples – wheat, barley, rye, and rice, as well as African sorghum, and New World potatoes and maize. Note it was through European contact that the potato was transported to North America. Also, it is interesting to note that both of these New World crops (as well as groundnuts in China) would ultimately serve to increase the European population in the New World; potatoes were central to the population growth in northern Europe, and maize in some areas, such as the Po valley in Italy, regions that later sent large numbers of immigrants to the New World.

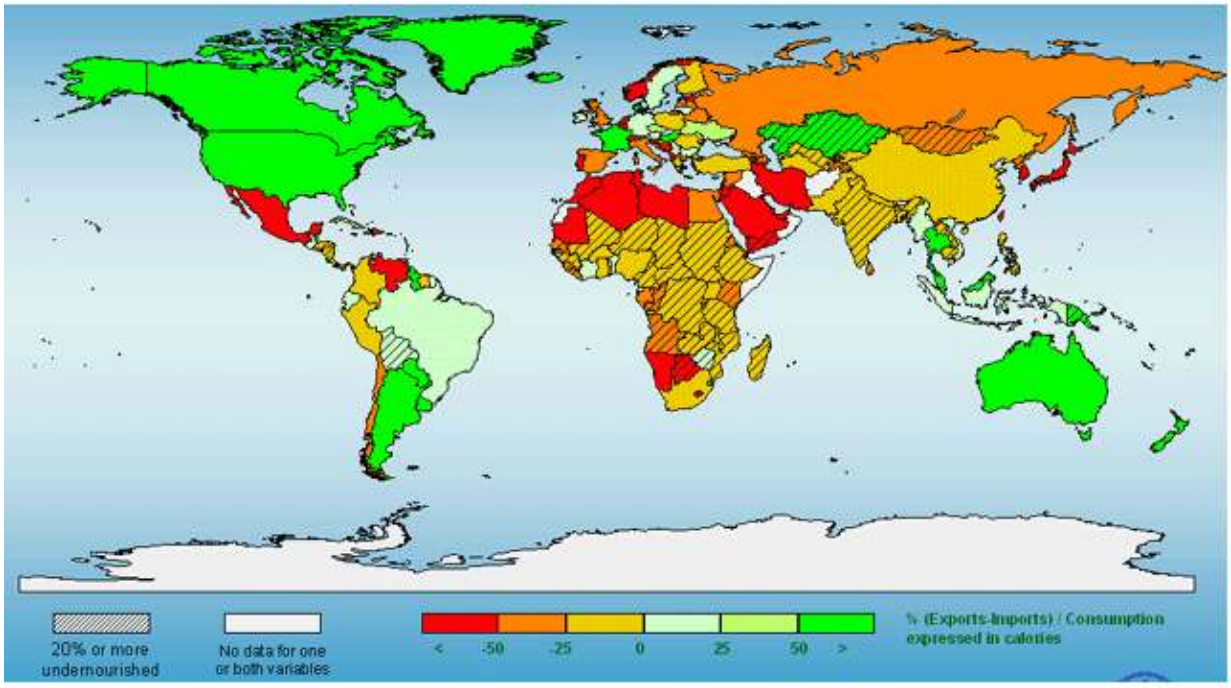

Figure 7-7 Net Trade in Food (World)
Source: Food and Agriculture Organization (FAO), United Nations (Data is for 1999-2001)

Similar data is shown as a cartogram in Figure 7-8, [107] a cartogram depicting countries rescaled in proportion to food aid measured in US dollars):

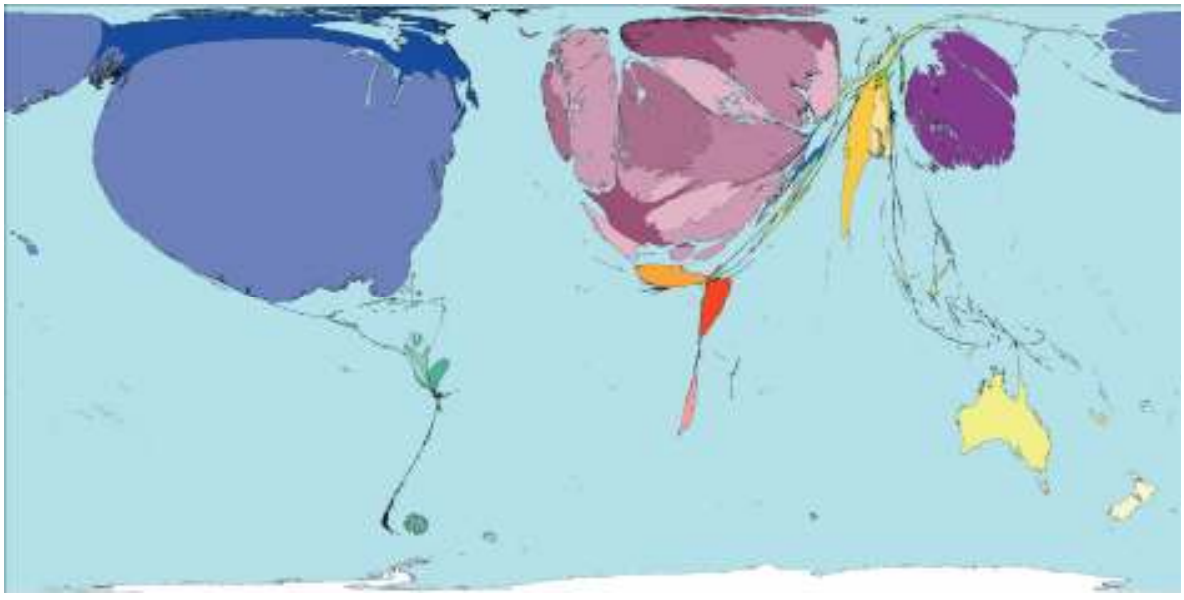

Figure 7-8 Cartogram Depicting Relative International Food Aid in US Dollars

[107] The southern cone of South America is less represented than in Figure 7.7 in part because its *total* production is smaller; note also that the bulge that looks like it might be Brazil in fact seems to be Argentina and Uruguay (based on FAO data on net trade in food).

Source: Social and Spatial Inequalities (SASI) Research Group. Data from the World Food Programme (WFP), 2005 Annual Report

Why is this relevant? These maps make immediately evident the biggest the flaw in the AJR 2002 natural experiment supporting their reversal of fortune argument that institutions 'trump' geography in explanation. Geography was *not* held constant in the period of colonization. AJR consider as 'geography' relatively unchanging factors such as latitude, soils, or climate. But one of most important intermediary geographical factors between such fixed factors and humans is *biogeography*. Biogeography experienced quantitatively its most radical change since the Pleistocene, and qualitatively perhaps its most drastic change ever - there has likely never been a similar, and so drastic, shift in the distribution of biota on a global scale in such a short time period. There have been mass *extinctions*, but never mass, virtually simultaneous, and global *introductions* of new biota on such a global scale as occurred with the 'Columbia Exchange'. Geography, far from being held constant during the period of colonization, went through one of its most abrupt and far reaching changes ever. Furthermore, the particular aspect of 'geography' that changed was one of the geographic factors most fundamentally important to humans, that related to food production (Appendix D lists the incredible number of Old World, largely temperate-suitable, often high-yield food producing flora that suddenly became available in the New Worlds; the change in regional food production capability was especially radical in the New World temperate zones). Any claim that 'geography' did not change during the time period of colonization could not be more wrong. Furthermore, the change is in the 'geography' most linked to the means of production and institutional development of the pre-industrial period.[108]

7.3 Conclusion

Considering AJR's argument is a useful example for several reasons. It shows how looking at data as descriptive statistics arranged in useful tabular arrangements can show strengths, weaknesses, and interconnections between data more clearly than

[108] How to think about the role of agency, both human and non-human, in such a process is considered in Foltz (2003). See also Drayton 2000, which 'makes space for the causal efficacy of the plants themselves' (Bravo 2002, 414).

statistical methods. The degree of spatial autocorrelation is especially clear in this format (just as Shalev noticed spatial autocorrelation in his reanalysis of Hall and Franzese in Section 6.4.2). In addition to highlighting areas where spatial autocorrelation is likely most pertinent, grouping data also makes clear where data is *missing*; empty cells stand out (and equally problematic – empty cells are in effect 'filled in' with imaginary cases - combinations of factors that occur in no real world cases - in statistical analysis and worse; still worse, this process is hidden). In the AJR example it is clear that the only way a statistical case could be made for a 'reversal of fortune' was through omitting the large number of cases from sub-Saharan Africa that saw no such reversal. Finally, viewing maps related to the topic makes evident something that apparently statistical considerations alone failed to bring to light to other researchers – the natural experiment that AJR base their argument on is fundamentally flawed. It is based on the idea that one set of factors ('geography') was held constant while another set of factors (institutions) changed, yet geography experienced during this time period one of its greatest changes ever. Mapping geographic data, and the ease with which mapped data draws out the history behind the data – the known mechanisms that link the change from one period to the next, and the location and degree of this change, make clear that AJR's statistical argument that a reversal of fortune shows institutions 'trump' geography simply is not correct as presented. This is important given that their argument that institutions 'trump' geography is widely cited and influential.

As noted in Section 5.8, we are not arguing that geography is *more* important than institutions, but rather that the question is incorrectly posed. Crucially, it ignores the different time scales and varying importance (and sequence) of the different types of factors. It is a bit like trying to decide whether kneading the dough or baking it is more important in making a loaf of bread: the question is illogical – both are equally important, but with their timing and purpose being very different.

For understanding many of the questions related to reducing poverty understanding the more immediate effect of institutions on development is more

important.[109] However, in any satisfyingly encompassing explanation of development, the long-term effect of geography on shaping spatial patterns of institutions is also of crucial importance.

7.3.1 Instrumental variables or geographic theories of development?

Interestingly, the search for instrumental variables that are truly exogenous has led to the use of geographic factors in numerous recent development studies (Chapter 1). The trend towards natural experiments and the use of instrumental variables, which are often geographic in nature,[110] has become so pronounced that, for example, both *The Chronicle of Higher Education* (Conley, 2003, on natural experiments) and *The Economist* (2006)[111] have remarked on it. For example, like AJR with reliance on the biogeography of disease and patterns of settler mortality for their natural experiment, Feyrer and Sacerdote (2006) use global wind patterns as an instrumental variable to randomize the length of exposure to colonial institutions of Pacific island cultures in order to judge the nature and strength of colonial influence on institutional and development outcomes. However, it becomes very difficult to tell whether these works are really *statistical* arguments relying on a statistical 'instrument', or simply geographic explanations of variation. For example, global wind patterns caused the pattern of high and low exposure of Pacific islands to European institutions in Feyrer and Sacerdote 2006 (and, most likely, centuries earlier, to human habitation more generally; see Di Piazza, Di Piazza and Pearthree 2007). Similarly, the biogeography of disease deeply influenced institutional distributions (AJR 2002). However, being as these events only occurred once, what is the difference between a 'test' using

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[109] Although as much of the work associated with Jeffrey Sachs and the Center for International Development (CID) at Harvard University has shown, many geographical factors still quite directly affect development, such as malaria and its effect on life expectancy (and thus investment in education), frost and its direct effects on agricultural productivity, poor soils and climatic variability and their effect on investment in agriculture and so on.

[110] Sometimes in surprising places; Hoxby 2000 famously uses topography and stream count data as instrumental variables randomizing data on educational test scores.

[111] 'Once just an obscure statistical method, instrumental variables are now popping up all over the place. Daniel Hamermesh, a labour economist at the University of Texas, has joked about the "instrument police", who patrol empirical economics, forever suspicious that causality may run both ways. Indeed, "reverse causality", which was once a frustrating problem, is now seen as a chance to demonstrate ingenuity. Instruments have brought colour to the study of institutions, and sharpened the debate over colonialism, without really resolving it. But whatever the claims of empire, the instrumental variable now enjoys an almost imperial grip on the imagination of economists.' ('Winds of Change: Why Economists Love Empires', *The Economist*, November 2, 2006).

geographic actors as instrumental variables and a simple geographic explanation of institutional spread?[112] Answering this question involves justifying assumptions and beliefs on the issues discussed throughout this dissertation, viz. contingency as discussed in Section 3.5 and interpretations of statistical arguments as discussed in Section 6.2.

[112] Rodrik et. al. 2002 briefly recognize the importance of making this interpretation, as well as its relationship to the exogeneity of factors, when they argue that 'an instrument does not a theory make' and 'emphasize the distinction between using an instrument to identify an exogenous source of variation in the independent variable and laying out a full theory of cause and effect. In our view, this distinction is not made adequately clear in AJR [2001] and is arguably blurred by Easterly and Levine (2002 [2003])' (Rodrik et. al. 2002, 18).

CHAPTER 8
FUTURE WORK, THEORETICAL AND EMPIRICAL

This dissertation is meant to help better understand crucial issues related to explanation that seem to be a key reason for a general feeling (Chapter 1) that there is a lack of progress towards satisfying explanations of uneven development in development studies. The dissertation is not intended as an empirical study of uneven development, although Chapter 7 and Appendix B serve as examples of how the ideas discussed in the dissertation might be applied empirically. Some further possibilities and directions of future empirical work are discussed in the last section of the dissertation (below). First, however, future theoretical work is considered.

8.1 Future Theoretical Work

One direction for future work is to take parts of the first half of the dissertation and unite them, independent of the empirical considerations in this dissertation, in a single philosophy of science theory of the role and importance of initial conditions in explanation. This could be accomplished by taking parts of Chapter 2, Chapter 3, and discussions of probabilistic causality from various parts of Chapters 1-4 and unifying them under a single theme - singular causation – in the following manner.

8.1.1 Consolidating the argument for initial conditions and explanation

As emphasized in the prefatory comments of the dissertation, development outcomes are single incidences - there is only one East Asia, one Peru, or one Silicon Valley. Various recent recognitions of this fact and direct and indirect references to the need for some type of explanation of singular outcomes in development studies led to the development of Chapter 2 on initial conditions and their importance to the explanation of irregularities, including uneven development.

The current structure of the first part of the dissertation reflects two things: 1) the sequence with which the links between various crucial concepts (such as exogenous factors, initial conditions, and open systems) were made and 2) the original goal of the

dissertation, which is ultimately to better understand uneven development and why there has been a marked increase in the empirical literature of discussions of contingency, initial conditions, and geographic/environmental factors (rather than a goal of developing a standalone philosophy of explanation). However, it is also important to more fully develop these arguments into a standalone philosophy of science, where they could then be applied more generally to the explanation of irregularities and singular outcomes (including uneven development). This could be accomplished by extracting the discussion of three concepts of singular causation mentioned in various parts of Chapters 1-4 (i.e., probabilistic causality, the 'natures' view of explanation, and the counterfactual view of explanation), consider the role of initial conditions in each of these, and how the use of and emphasis on initial conditions preempts the need for each of these.

8.1.2 The L+IC concept and three alternatives: Probabilistic explanation, counterfactual explanation, and 'natures'

Modern discussions of scientific explanation generally start with the formalization of an ancient concept of explanation using regularities (laws of nature) and initial conditions that became widely associated with the deductive-nomological (D-N) 'model' associated with Popper, Nagel, and especially, Hempel. ('Issues concerning scientific explanation have been a focus of philosophical attention from Pre-Socratic times through the modern period. However, recent discussion really begins with the development of the Deductive-Nomological (*DN*) model', Woodward 2003, para. 1.) The 'D-N model' of explanation was rejected from the 1960s partly because of its association with and general reaction against positivism[113] (and deterministic laws of nature) more generally, and often more specifically because it was conceived of as a

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[113] In the following passage both the view that there is a basic relationship of the D-N model to (the many forms of) positivism as well as a moral basis for its objection are evident:

> for the purpose of this book, which is to combat the contemporary positivist influence on moral philosophy…it may not be unjustified to simplify matters and use the D-N model as a focus for discussion. For all forms of positivism, in spite of their differences, agree that the relationship of deducibility is crucial to the scientificity of a discipline. The D-N model is invoked in this spirit to display the centrality of that relationship.' (Lee 1985, 32).

Note that among geographers the reaction against 'positivism' was as least as strong as in the rest of the social sciences. For example, Turner writes (on attempts at bridging the human - environment divide in geography) that 'Unfortunately, much of this bridging is accompanied by the apparent requirement to denounce "straw person" logical positivism, as if the dead horse has to be beaten regularly lest it rise to run another race.' (Turner 1997, 216).

'regularity account' of causation; it was not evident how it could, even in principle, account for single events, which of course are of central interest in many areas of study outside of physics and chemistry (i.e., in the 'historical' sciences, from cosmology to geology to human history). One of the earlier alternatives to the D-N model was probabilistic (including the inductive-statistical' or 'I-S model', put forth by Hempel himself [Hempel 1965; Irving John Good precedes Hempel in his 1961 and 1962], followed by numerous other probabilistic concepts of explanation [e.g., Suppes 1970]). Although probabilistic causality is often spoken of in terms of being an *alternative* to *regularity* accounts of causation, a converse way to think of it is as explaining *single* incidences (that are exceptions to an expected regularity).[114]

Probabilistic causation became (and remains) the center of intense consideration by scholars. However, the combination of the strong rejection of the 'D-N model' and problems (still unresolved) with probabilistic accounts of causation with the continued belief that an account of singular causation was crucial to explanation resulted in two other important alternatives to the D-N regularity account of explanation. One of these was the various concepts of counterfactual causation (an early example is Lyons 1967, and especially following the tremendously influential Lewis 1973).[115] Rather than look for constant conjunctions in series of relationships between things, one could consider a single example, and consider what would happen in a counterfactual world if a cause were different; this concept of explanation seems inherently suited to the consideration of singular causation. Finally, in 1975, Bhaskar published his open system argument for neo-Aristotelian 'natures', subsequently further developed by Cartwright.[116] Natures are also inherently suited for the explanation of singular outcomes – if things have inherent natures that cause their actions then there is

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[114] E.g., 'Cartwright concludes that the probabilistic theory of causality must thus invoke *singular* causes, as she does in her [1989, page 96]', (Eells 1995, 172).

[115] E.g., 'Lewis's theory [of counterfactual causation] is not intended as an account of type [regularity] causation but rather as an account of token [singular] causation' (Woodward 2001, 40).

[116] On the link between Bhaskar and Cartwright: Early on while studying these fields it seemed to me that Cartwright's work was remarkably similar to Bhaskar's, yet there was oddly little recognition of this in the literature on either (with a few exceptions, such as Chalmers 1987). Finally I decided to enter their names together in databases and found there were indeed a surprisingly small number of works and websites that reference the two together (as of 2005; in recent years there seems to be some increase in noting their similarities). One of the top results was David Spurrett's (1999) excellent doctoral dissertation from the University of Natal which proved useful in making further connections between a number of important concepts.

(ostensibly) no need to appeal to regularity accounts of causation for explanation. One only need understand the nature of a thing to account for why it acts as it does. [117]

However, I argue that the L+IC concept of explanation (with an emphasis on initial conditions rather than laws) proposed here holds the potential to resolve the problems that motivated the development of these alternative attempts to explain singular outcomes. It preempts the need for counterfactuals,[118] fundamentally mysterious 'ontological chance', or essentialist, neo-Aristotelian 'natures', 'tendencies', or 'capacities'.[119]

Unifying and developing the L+IC concept of explanation using the discussions from Chapters 1-4 of the dissertation on probabilistic, counterfactual, and 'realist' views of explanation/causality is a primary area of future development. This would achieve two novel results: 1) showing clearly the little commented upon unity of purpose between probabilistic, counterfactual, and 'realist' views of explanation/causality and 2) more importantly, show that attention to initial conditions *preempts* these accounts of explanation/causation. The L+IC approach to explanation achieves what they were developed to achieve while simultaneously making apparent the reasons why these alternative accounts of explanation/causality have failed.

8.2 Future Empirical Work

The immediate goal of seeking a better *theoretical* understanding of explanation in spatial explanation was motivated by an ultimate interest in achieving more

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[117] '[T]raditional empiricist, or Humean, understandings of causality attempted to reduce whatever there is to the idea of causality to the idea of constant or at least regular associations between or among event types, while Cartwright commits herself to the idea that there is something real about actual individual (singular) causes that bring about effects (that something real being nature's capacities'(Eells 1995, 169; this observation fits Bhaskar equally well).

[118] Problems with counterfactuals are discussed in Chapter 3. Basically, arguing counterfactuals are useful in showing causality puts the cart before the horse: Counterfactual possible worlds can supply no *new* causal information about the real world. Rather, *already existing* causal beliefs from the *real* world are the very thing that allows for 'plausible' counterfactuals to be imagined at all - and discerned from other, 'implausible' counterfactuals.

[119] In addition to the discussion in Chapter 2, a basic problem with a natures view is that it does not escape from the problem of constant conjunctions. Bhaskar and Cartwright reject law accounts of causality because in the real world constant conjunctions are rare, so one should be skeptical that laws are universal. However, if natures are the cause of things, and manifest themselves in some cases but not in others, they can be criticized for precisely the same reason: How can one know the natures are present in the cases where they are not manifested?

satisfying *empirical* explanations of uneven development. The previous section outlined possibilities for further theoretical work related to explanation. This section considers future empirical work. It is not intended to serve as an empirical section of the dissertation, but merely to show possible directions of future work, and is therefore intentionally brief. An important goal is to show that there is unused or new spatial data available for more carefully considering important questions related to the unevenness of development, and how visualization of this data with maps and as descriptive statistics can be especially useful (Chapter 6). The particular empirical areas of interest are related to the long-term evolution of the distribution of industrialization and related political-economic factors such as institutional development, trade and trade policies.

It has become common to note the failure of neoclassical economics to explain economic divergence between countries and regions. In recent years this has frequently been attributed to some countries developing or capturing industries with increasing returns; viz. that the agglomeration effects typical of increasing returns industries are sensitive to slight differences in initial conditions that over time lead to further agglomeration and thus increasing divergence rather than convergence between regions and countries (Romer 1986, Krugman and Venables 1995, Fujita and Thisse 2002).

Just as the lack of short-term convergence among modern economies can be attributed to the capturing of increasing returns-to-scale activities, many believe Europe (and its settler colonies) did this on a long-term, global scale as well, in a global division of labor at the state and regional level (in the economic history literature, this process is often explained in other language *viz*., that Europe deindustrialized its colonies, e.g., in dependency theory in general, and works such as Amin 1976, Forbes and Rimmer 1984, and Alam 2000). This long-term, increasing returns perspective is interesting because it can be seen as (regarding reasons proposed for the ‘great divergence’ in economic levels of development that economic

historians now tell us happened mainly in the last few centuries[120]) merging or at least compatible with both many recent mainstream economic observations related to regional economics, agglomeration, and increasing returns-to-scale activities (the 'new' trade theory and related 'new' economic theories) and aspects of important heterodox arguments (Marxist/dependency theories, some Austrian economics, and much evolutionary economics [related to competition, for example]).

How, then, did European states rise in the international division of labor? A frequent answer is that European expansion ('trading-post', colonial, and imperial expansion – see Curtin 1989 and 2000 for the important yet often ignored distinctions between stages and types of European expansion) was a crucial cause for many reasons including through its windfall effects on Europe's place in world trade (emphasized, for example, by Blaut 1993 and Frank 1998), its effects on avoiding material limits to European growth (e.g., Pomeranz 2000) and its influence on European institutional development (e.g., Acemoglu et. al. 2005).

The State System and Mercantilist Policies

This answer, though, only serves to raise another question: Why, then, was Europe so aggressive at (and successful in) expansion? Perhaps one of the most commonly shared answers (besides the global exchange of diseases favorable to Eurasians, especially in the Americas[121]) is that the European state system and the competition that it fostered both caused the competitive and therefore aggressive expansion and increased the chances it would be successful, as earlier state competition had increased the technological, military, and bureaucratic capability of European states vis-à-vis non-European states. Indeed, of all of the factors viewed as important to European development, Europe's state system is probably the most widely agreed upon factor: In a recent comprehensive review of the role of the state in 'the rise of the West' P.H.H. Vries notes 'There is hardly a text on the rise of the West in which

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[120] It is now generally accepted that much of the divergence between Europe and other advanced economies has occurred *since* the industrial revolution, suggesting that the divergence is less due to older, 'internal' or basic sociocultural differences between world regions and more to more recent processes inherent in worldwide industrialization (unless, of course, one makes arguments that the industrial revolution *itself* is due to earlier, more innate differences between Europe and other regions; Jones 1981 and 1988, among others, use the language of 'internalist' and 'externalist' views of European development).

[121] And - often overlooked - especially *unfavorable* in Africa, greatly changing both the nature and the timing of African/European interaction compared to other regions (Curtin 1989).

reference to [the European state system] and its positive effects is not made' (2002, 68) and goes on to list a wide range of scholars from many political orientations: Arrighi (1994), Baechler (1995), Baechler and Mann (1988), Braudel (1979), Cosandey (1997), Crone (1989), Gellner (1988), Goldstone (1991), Hall (1985), Huang (1999), Jones (1981), Landes (1998), Mann (1986a and 1986b), McNeill (1982), Pomeranz (2000), Powelson (1994), Rosenberg and Birdzell (1986), Sanderson (1995), Wallerstein (1974, 1980, 1989), Weiss and Hobson (1995), and Wright (2000).

Even scholars critical of arguments that seem to privilege the West or capitalism emphasize the importance of the state system in Europe's unique development trajectory. For example, Anthony Giddens writes that 'However much one might distrust the nature of the contrast drawn between Europe and the "despotic" East by Montesquieu and his contemporaries, there is no question that the character of Europe, as a series of socio-political formations, differed over the long term from the imperial societies of Meso-America, the Near and Far East. During the sixteen hundred years or so which succeeded the disintegration of "its" empire, Rome, Europe did not experience the rise of another imperial society in its midst…Europe was a "state system" for the whole of this period' (Giddens 1981, 183). The fact that these scholars disagree on so many other points related to development yet are in basic agreement concerning the centrality of the European state system to Europe's unique development trajectory suggests that there is indeed something important about this factor.

All of the above authors argue in part or entirely that:

- The military technology and capacity of European states (particularly vis-à-vis non-European regions) was enhanced through war or the threat of war. This would become highly relevant once colonization became a competition between European states.

- The bureaucratic capacity of European states was enhanced through war or the threat of war.

- Political competition led to economic and territorial competition, exploration, and expansionist policies.

- State competition (and a large number of states and high degree of trade) increased the chances that early trading-post and colonial (and later imperial) expansion world occur in the first place.

The competitive policies towards technological development, trade and acquisition of raw materials for manufacturing were sometimes ill-defined and erratic, but nevertheless the very real policy among European states starting as early as the 1500s and lasting for centuries (Reinert 1994, 1995, 1998). These policies can broadly be described as (or said to define) mercantilism (and colbertism and cameralism in the French and German traditions, which would also strongly influence Japan, the US, and other nations); as Schmoller describes the mercantilist system: 'The essence of the system lies not in some doctrine of money, or of the balance of trade; not in tariff barriers, protective duties, or navigation laws; but in something far greater: - namely in the total transformation of society and its organizations, as well as of the state and its institutions, in the replacing of a local and territorial economy by that of the national state' (Schmoller 1896 from Reinert 2004, 10).

Mercantilism has received very little attention in the twentieth century,[122] and much of the attention it has received has often used mercantilism as a straw-man foil to present particular theories in a good light, with numerous misrepresentations often intentionally introduced. This has led to widespread acceptance of simplistic and erroneous views of mercantilism which in turn still further decreases attention to the subject. Paul Rich states that 'There are few better examples of trying to lend

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[122] Mokyr, for example, in discussing Heckscher's (1931) extensive treatment of mercantilism, observes 'the book seems to have been strangely neglected by economic historians in recent decades. Mercantilism as a major topic in the institutional development of Europe has not yet been taken up by the New Institutional Economics.' (Mokyr 2003, 1). In a footnote Mokyr notes: 'Of the forty five references to Heckscher's work on Mercantilism in the two leading Economic History journals, thirty five were made before 1971, and only four since 1980. Of the thirteen citations in the entire economics and history sections of JSTOR to Heckscher's work on Mercantilism, only five papers qualify as economic history proper. A recent well-reviewed book (Epstein, 2000), clearly concerned with similar issues, does not even refer to it. (Mokyr 2003, 1). McCusker writes 'Indeed, by mid-century, some were prepared to deny that mercantilism as an economic doctrine had ever existed' (McCusker 2000, para. 1) and that after World War II 'mercantilism was irrelevant. After the demise of the world of nation states, it seemed to some best forgotten and, with it, the doctrine that had served to underpin its foundation. By the middle of the twentieth century more than one writer on the early modern period of Western European history was prepared to deny mercantilism's very existence. … The most extreme of these writers, D. C. Coleman (1980, p. 791), classed mercantilism with other "non-existent entities."'. (McCusker 2000, para. 10).

More generally, if all of the JSTOR articles from history, political science, and economics from the entire twentieth century and to the present with any of the words 'mercantilism', 'colbertism', or 'cameralism' in the title are considered, there are only 46 articles, of which only 12 have been published after 1980 (the date of Coleman's 'Mercantilism Revisited'), and these are mostly either narrowly focused responses to Ekelund and Tollison's (1982) public choice interpretation of mercantilism or discussions of modern trade theory as 'neo mercantilism'.

misleading coherence to complex matters than the way in which mercantilism has been dismissed as a spent philosophy' (Rich 2006, 183).[123]

Mercantilism seems to have been ignored and even disparaged by both the right and the left, accounting for the scant attention paid to the historical impact of these policies in the twentieth century. The left, while embracing the state's role in development, rejects the capitalist and 'internalist' (and often, viewed as triumphalist) view of Europe as a region developing economically largely due to internal institutional development stimulated by its own internal dynamics of intra-state competition and commerce. Conversely, the right, while embracing the emphasis of mercantilism on a 'fragmented and thus competitive' internalist model of European expansion, cannot embrace mercantilism because of its emphasis on the role of the state in development. Thus mercantilism has found little support or attention in the twentieth century from any side.[124]

Consequently, there are a number of widespread misunderstandings concerning mercantilist policies. One is that mercantilism is simply a naïve focus on the balance of trade (or worse still, as an even more simplistic focus on the stock of precious metals, properly called 'bullionism'). The mercantilist approach to trade and development was in practice much more nuanced, based on views on 'good' trade and 'bad' trade. Good trade is trade that increases the amount of increasing returns activities (in that time especially, essentially manufacturing) within a country's

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[123] McCusker, for example, in discussing one of the few modern widely read discussions of mercantilism notes: 'Unfortunately in their exploration of the subject Ekelund and Tollison offer little more than "poor history," "circular arguments," and a disinterest "in what the mercantilist writer actually wrote," according to Magnusson (p. 50), an evaluation with which I can only agree, sadly' (McCusker, note 8).

[124] McCusker makes a similar argument in discussing the reception of Heckscher's (1931) book on mercantilism: 'The book and its subject had less play in the second half of the twentieth century when the worries of the world shifted from a fear of totalitarianism of the right to a fear of totalitarianism of the left. Indeed, by mid-century, some were prepared to deny that mercantilism as an economic doctrine had ever existed, (McCusker 2000, para. 1)

and

> As World War II came and passed, many thought they saw the future in an even newer and now victorious doctrine, socialism. For them Heckscher was even less relevant - or, better put, mercantilism was irrelevant. After the demise of the world of nation states, it seemed to some best forgotten and, with it, the doctrine that had served to underpin its foundation. By the middle of the twentieth century more than one writer on the early modern period of Western European history was prepared to deny mercantilism's very existence. … The most extreme of these writers, D. C. Coleman (1980, p. 791), classed mercantilism with other "non-existent entities." It was an invention, conjured up "to prevent the study of history from falling into the abyss of antiquarianism" (7). With hated capitalism under attack from the bastions of academe, mercantilism suffered the even worse fate of being ignored. (McCusker 2000, para. 10).

borders; bad trade is trade that increases a reliance on raw materials exports (see Reinert 1998). Furthermore, much confusion arises because of the difference in the significance of arguments concerning trade originating in the context of the country by far more industrialized (Great Britain, and later, also the US) and the significance of those arguments for everyone else: In the real world, the implications of 'free' trade turned out to be very different for the world leaders in industrial production than for less industrialized nations. It has seldom been grasped how fundamentally this influenced the interpretation of economic theory in different countries, especially in the English speaking countries vis-à-vis the rest of the world (Reinert 1998).

Another misunderstanding concerning mercantilist policies is that they are frequently portrayed as attempting to capture trade and industry due to a naïve belief that these are a 'zero sum game' when in reality trade and industrial growth are very much a '*non*-zero sum game', with cooperative free trade increasing the total amount of goods for all. Mercantilists are portrayed, in effect, as believing (in their ignorance of the non-zero sum nature of development) that taking one country's ten percent meant the winner would have sixty percent and the loser be left with forty percent of the pre-existing trade or industry levels, and ignorant of the possibility that with increased trade there may be 500 percent more goods and industry in the future for all to share. However, in a non-zero sum world *strongly marked by agglomerative forces* (whatever these may be), mercantilist strategies make *more*, not less sense than non-competitive policies: that is, taking a rival's ten percent now might leave the 'winner' with 500 percent more of an industry in the future, and the loser with none, a more likely outcome in the real world of agglomeration than each ending up with 250 percent more industry. Crucially, in a non-zero sum world *of increasing returns and agglomeration*, mercantilist strategies were *especially* astute and beneficial, although only, of course, to the 'winners'.

Based on these observations, the future empirical work I plan to carry out might be described as a 'geography of mercantilism' that seeks to understand how mercantilist policies, so intricately associated with both the military and commercial expansion of Europe that subsequently shaped global patterns of development,

became spatially 'centered' (as writers such as Blaut and A.G. Frank often characterize the process) on Europe.[125]

Preliminary Observations and Data

Before exploring the historical relationship between increasing returns industry and development, it might be useful to measure the *modern* relationship of the ratio of increasing returns production (manufacturing) and decreasing returns production (primarily agriculture) (see Reinert 1996) and levels of development such as gross national income.

This can be done using the schema for classifying the development levels of countries developed by Hoeschele (2002). Rather than judging development on a one dimensional measure such as GDP, it is useful to use several dimensions reflecting

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[125] Given the generally negative moral impressions of mercantilism and the connections made between geography and ethics in Chapters 4 and 5 it is interesting to note that the regional self-sufficiency that mercantilist and neo-mercantilist policies might be interpreted as supporting (see especially Jacobs 1984; Lovering 1999 sees 'new-regionalism' as a form of neo-mercantilism and criticizes it accordingly as 'instrumentalist, 'Hayekian rhetoric' etc.; Jacobs 1961, 1969, 1980, 1984, 1992 and 2000 seem to me more accurate and insightful considerations of localism/regionalism and its advantages) and opposition to hyper-specialization might be seen as being related to society's ethical relationship with the environment. A good example is expressed by Michael Pollan, who builds on the ideas of farmer-philosopher Wendell Berry (1972, 1977):

> For Berry, the deep problem standing behind all the other problems of industrial civilization is "specialization," which he regards as the "disease of the modern character." Our society assigns us a tiny number of roles: we're producers (of one thing) at work, consumers of a great many other things the rest of the time, and then once a year or so we vote as citizens. Virtually all of our needs and desires we delegate to specialists of one kind or another — our meals to agribusiness, health to the doctor, education to the teacher, entertainment to the media, care for the environment to the environmentalist, political action to the politician.
>
> As Adam Smith and many others have pointed out, this division of labor has given us many of the blessings of civilization…Yet this same division of labor obscures the lines of connection — and responsibility — linking our everyday acts to their real-world consequences, making it easy for me to overlook the coal-fired power plant that is lighting my screen, or the mountaintop in Kentucky that had to be destroyed to provide the coal to that plant, or the streams running crimson with heavy metals as a result.
>
> …[specialization due to cheap fossil fuel] allows us to pay distant others to process our food for us, to entertain us and to (try to) solve our problems, with the result that there is very little we know how to accomplish for ourselves. Think for a moment of all the things you suddenly need to do for yourself when the power goes out…how a power failure causes your neighbors — your community — to suddenly loom so much larger in your life. Cheap energy allowed us to leapfrog community by making it possible to sell our specialty over great distances as well as summon into our lives the specialties of countless distant others. (Pollan 2008)

Overspecialization due to globalization and the commoditization and marketization of all aspects of life distances individuals from the environment and breaks the bonds of community making individuals feel both that they are powerless to change human-environment relations and reducing their understanding that it is important to do so. The neo-mercantilist type economies Jacobs and others argue for may be a good way to balance the reality of modern technological economies with regional self-sufficiency and diversity.

important aspects of an economy. Measuring the balance between increasing returns-to-scale sectors and decreasing returns-to-scale sectors is one method that gives a clearer indication of *types* of economies, beyond just their wealth. (This data was shown previously in Chapter 6 because it shows the spatial autocorrelation in measures of global development quite clearly).

Using data on manufacturing sectors from the United Nations Department of Economic and Social Affairs (the Standard International Trade Classification or SITC) Hoeschele develops a measure of core industrialized manufactures (CIM - textiles, metals manufactures, chemicals, paper and paper products) and natural resource intensive agricultural and mining products (NRI - basic metals, foods, beverages tobacco, wood and wood products). Using data from the Food and Agriculture Organization (FAO) Hoeschele develops a measure of the non-agricultural population of countries. Countries are plotted against each other using these measures, and Hoeschele then divides them into six categories.[126] These are

IC (*I*ndustrialized, *C*ore industrial manufactures exporting)

IN (*I*ndustrialized, *N*atural resource intensive exporting)

PIC (*P*artially *I*ndustrialized, *C*ore industrial manufactures exporting)

PIN (*P*artially *I*ndustrialized, *N*atural resource intensive exporting)

LIC (*L*east *I*ndustrialized, *C*ore industrial manufactures exporting)

LIN (*L*east *I*ndustrialized, *N*atural resource intensive exporting)

In Figure 8.1 the x-axis measures the percentage of non-agricultural population in a country, while the y-axis measures the percentage of industrial exports.[127]

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[126] Hoeschele's original division is modified here to approximate a lognormal distribution and equalize the number of observations in each category; this also happens to more closely match the world regional divisions discussed in Chapter 6, Section 5 and shown in Figure 6.10.

[127] The extreme outlier 'np' is Nepal; its unique position is due to the dominance of its small economy by textile exports (98%). Pakistan (pk), Bhutan (bt), and Bangladesh (bd) have similar economies, although less extremely focused on a single industry.

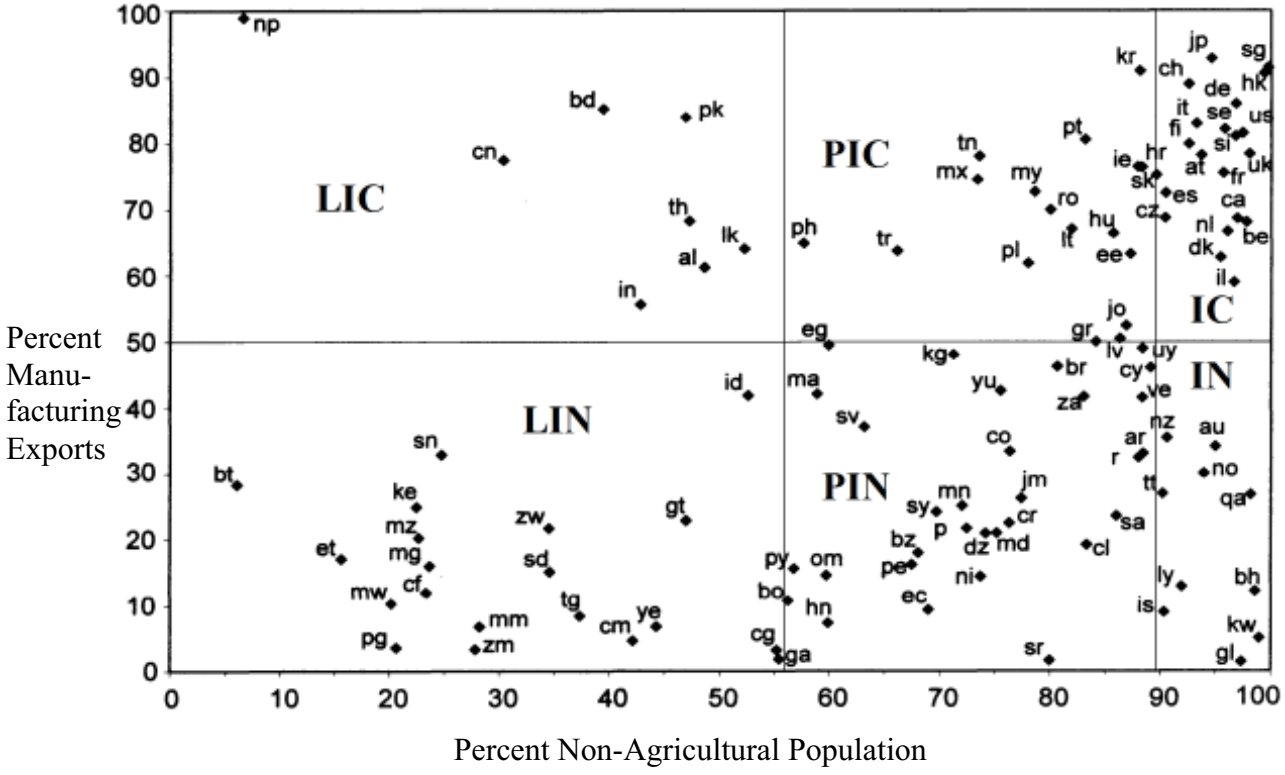

Figure 8-1 Hoeschele's Alternative Classification of Economies
Source: Adapted from Hoeschele 2003

Abbreviations (Internet domain names of countries)

al Albania
ar Argentina
at Austria
au Australia
bd Bangladesh
be Belgium
bh Bahrain
bo Bolivia
br Brazil
bt Bhutan
bz Belize
ca Canada
cf Central African Republic
cg Congo
ch Switzerland
cI Chile
cm Cameroon
cn China
co Colombia
cr Costa Rica
cy Cyprus
cz Czech Republic
de Germany
dk Denmark
dz Algeria
ec Ecuador
ee Estonia
Eg Egypt
es Spain
et Ethiopia
fi Finland
fr France
ft Trinidad and Tobago
ga Gabon
gl Greenland
gr Greece
gt Guatemala
hk Hong Kong
hn Honduras
hr Croatia
hu Hungary
id Indonesia
ie Ireland
il Israel
in India
is Iceland
it Italy
It Lithuania
jm Jamaica
jo Jordan
jp Japan
ke Kenya
kg Kyrgyzstan
kr South Korea
kw Kuwait
lk Sri Lanka
lv Latvia
ly Libya
ma Morocco
md Moldova
mg Madagascar
mm Myanmar
mn Mongolia
mw Malawi
mx Mexico
my Malaysia
mz Mozambique
nI Netherlands
ni Nicaragua
no Norway
np Nepal
nz New Zealand
om Oman
pa Panama
pe Peru
pg Papua New Guinea
ph Philippines
pk Pakistan
pl Poland
pt Portugal
py Paraguay
qa Qatar
ro Romania
ru Russia
sa Saudi Arabia
sd Sudan
se Sweden
sg Singapore
si Slovenia
sk Slovakia
sn Senegal
sr Suriname
sv El Salvador
sy Syria
tg Togo
th Thailand
tn Tunisia
tr Turkey
uk United Kingdom
us United States
uy Uruguay
ye Venezuela
ye Yemen
yu Yugoslavia
za South Africa
zm Zambia
zw Zimbabwe

The Hoeschele classification of economies can be used to judge the relationship between urbanization/industrial exports and material well-being. Table 8.1 (next page) is divided into six columns representing the six divisions in Hoeschele's measure. The shaded columns represent the three upper categories in Figure 8.1 (IC, PIC, LIC). The white columns represent the three bottom categories (IN, PIN, LIN). The columns are divided into five rows representing low, medium-low, medium, medium-high and high measures of Gross National Income (World Bank 2002).

This table allows for the comparison of countries based on both their level of development and their types of economies. The primary importance of this data is that it suggests that in the modern economy, having both a more urbanized economy and more industrial exports is especially associated with greater wealth, although each in somewhat different ways.

Table 8-1 Gross National Income and the Hoeschele Classification
(next page)

Source: Data from Hoeschele 2003; GNI data are from the World Bank, 2002

	IC	IN	PIC	PIN	LIC	LIN
High GNI 17350+	Switzerland Germany Austria Italy France Spain Netherlands Sweden Finland Denmark U.K. U.S.A. Canada Israel Japan Singapore Hong Kong	Norway Iceland Greenland Australia New Zealand Kuwait	Ireland Greece Portugal	Cyprus		
Med-High GNI 6650-17350		Bahrain Trinidad and Tobago	Hungary Slovakia Czech Republic Poland Estonia Latvia Croatia Korea Malaysia Mexico	Russia Yugoslavia Brazil Uruguay South Africa Saudi Arabia Oman	Thailand	
Medium GNI 4280-6649			Romania Turkey Tunisia Philippines	Venezuela Colombia Peru El Salvador Paraguay Belize Egypt	Algeria China	Gabon
Med-Low GNI 1650-4279			Jordan	Ecuador Honduras Bolivia Morocco	Albania Sri Lanka Pakistan Bangladesh	Guatemala Indonesia Sudan Zimbabwe Papua/New Guinea
Low GNI Below 1650				Moldova Kyrgyzstan Mongolia	Nepal	Congo Cameroon Togo Zambia Senegal Kenya Madagascar Central African Republic Malawi Ethiopia Yemen

Towards a Geography of Mercantilism

Critically, the relationship demonstrated in Table 8.1 seems to hold historically. Economic growth is closely associated with mercantilist policies in industrialized countries over a period of centuries (Bairoch 1993; Reinert 1994, 1996; see also Williamson 2002. Similar arguments are found in Jacobs 1984 especially on the misunderstandings of the rejection of import substitution; Masters 1988 shows the results of European mercantilist policies historically against an area of free trade in the Ottoman Empire; there are, of course vast and closely related literatures on the usefulness of import replacing and protectionism, globalization, and free trade).

The question I will seek to address empirically is: If economic growth is associated with mercantilist policies historically, and the concentration within a state's borders of increasing returns industries both historically and in modern data, what has caused the *spatial* distribution of mercantilist policies?

There seem to be at least three factors that are necessary for mercantilist policies to develop in a world region: 1) There must be a high *amount of trade* 2) there must be a sufficient *number of states* to stimulate competition among them 3) they must be sufficiently *centralized*, *bureaucratically effective* states. Without (1) there would be little to gain from mercantilist policies, without (2) there would be little motivation to be competitive and no competitors from which to gain, and without (3) there would be no way to effectively *implement* competitive policies.

To some degree the third condition is a result of the first two; there are arguments that trade stimulated the rise of and improved the quality or efficiency of institutions (Knack and Keefer 1995; Acemoglu et. al. 2005; this connection is often thought to occur in close conjunction with urbanization, e.g., Fox 1971, 1989, 1991; Jacobs 1969, 1984). There are also arguments that many, closely interacting states and the resulting interstate competition increased bureaucratic centralization and effectiveness, especially via military competition increasing bureaucratization (e.g., taxes levied to support the military, centralization of powers to enforce taxation, censuses in order to gauge war-making capacity - see especially Tilly 1990, as well as Spruyt 1994 and the long list of examples from de Vries 2002 above). These interrelated aspects of regional state and institutional development then become self-

reinforcing in Myrdal-type cumulative causation: States with strong or effective institutions in turn were able to trade more and compete more effectively, further improving their institutions and so on.

Although aspects of these relations have been discussed many times, there is now more and better spatial data that allows for these questions to be more carefully considered empirically, and in particular, the spatial distributions of these social processes to be explained better than in the past, taking out the circularity inherent in aspatial discussions of development (Chapter 5).

For example, Mellinger, Sachs, and Gallup (1999) and Rappaport and Sachs (2001) collect data that shows the close historical and modern association of low transport costs with high levels of trade and industrial agglomeration. Some of their data is easily visualized and shows the close relationship between transport costs and spatial patterns of high trade and economic development. For instance, Mellinger, Sachs, and Gallup map data on the transport capacity of world rivers. Taking coasts and ocean navigable rivers and highlighting the areas within easy land-transport range (100 kilometers) of these provides a good picture of the relative transport cost potentials of world regions. This transport-cost data can then be usefully compared to other extensive data, such as the following.

In recent decades detailed and accurate maps of the density of global economic production have been developed (a reflection of both the population density and economic productivity of a region). Comparing transport-cost data and GDP density measurements reveals the long-term influence of transport costs potentials on cumulative levels of population and economic activity (spurious correlation or reverse causation are ruled out by the many detailed historical accounts of the mechanisms linking transport costs with both population growth and economic and industrial location). In Figure 8.2 the upper section highlights in black 100 kilometers inland of ice free coast and on both sides of ocean navigable rivers. Directly below it is a modern detailed map of global GDP density. Note the close spatial correlations between the factors.

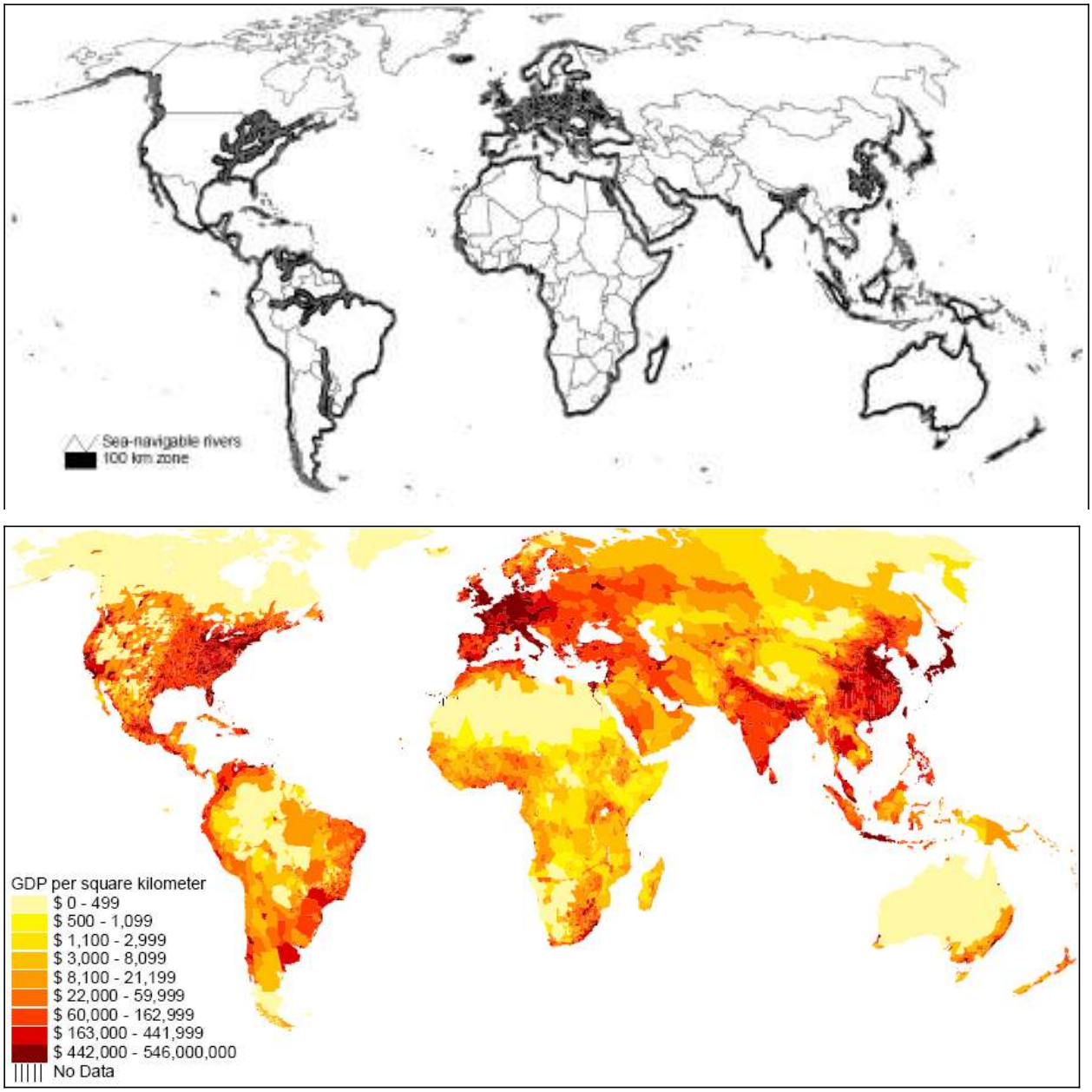

Figure 8-2 Global Water Transport Potential and GDP Density
Sources: Mellinger, Sachs, and Gallup 1999

The statistical methods of measuring GDP density used in Figure 8.2 may be inaccurate for a number of reasons, with two especially important limitations being 1) the estimated two billion people, especially in rural areas and developing countries, which remain outside of the formal economy and 2) that areas with high levels of economic activity such as commercial centers, warehouse districts, industrial zones, and airports have low resident population densities. A useful method for correcting these problems is to *directly* measure the spatial distribution of economic activity

using measures of nighttime light emissions, which serve as an especially accurate spatial indicator of both the distribution and intensity of economic activity (Doll et al. 2000; Sutton and Costanza 2002). Below (Figure 8.3) is a photograph of global light emissions, again compared with a map showing the 100 kilometer zone of coasts and ocean navigable rivers (this time using a negative of the image for easier comparison with the light emissions image).

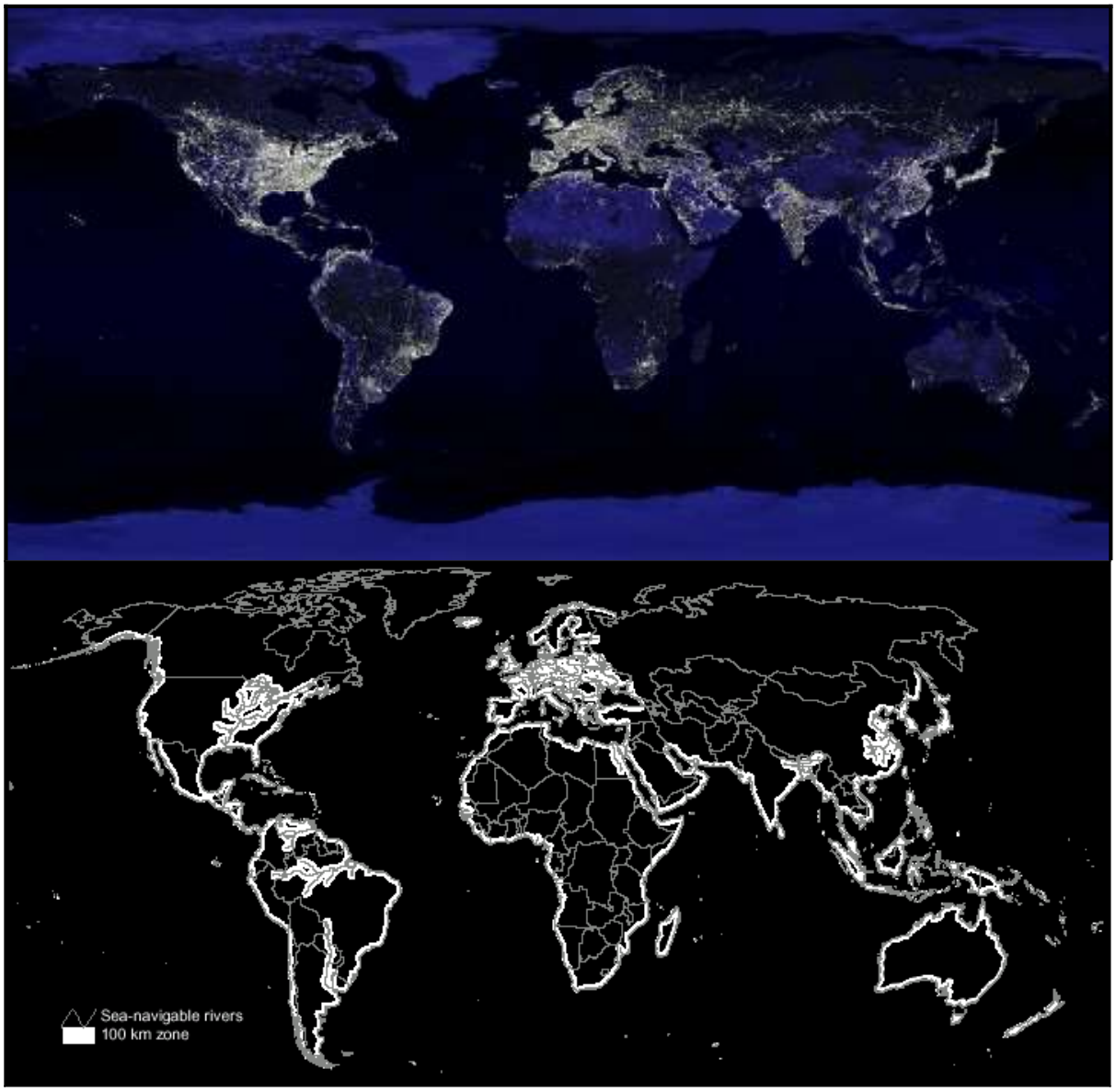

Figure 8-3 Global Light Emissions Compared with Land Within 100 Km. of Ocean Navigable Water
Source: NASA (top) and Mellinger, Sachs, and Gallup (1999, 28)

Again the close correlation between the exceptionally low transport costs associated with water transport and the density of economic activity are evident, suggesting the effects of long-term and cumulative causation of transport costs on population and industrial agglomeration.

Just as there is now much more extensive, accurate, and detailed data available to consider older arguments on relationships between transport costs and development (the first factor mentioned as necessary conditions for mercantilist policies to develop) there is likewise data that might be used to revisit arguments concerning the *number* and *strength* of states in world regions (the second and third factors mentioned as necessary for mercantilist policies to develop). Much of this data is also usefully visualized with descriptive statistics and maps (the current section on future work has only partially begun to do this).

Factors Two and Three: Number and Strength of States

Recent global yet detailed data, such as the Global Agro-Ecological Zones (GAEZ) data[128] has been developed related to distributions of agricultural potential. GAEZ measures numerous important factors with thousands of observations at 1 degree by 1 degree scales or smaller including critical data on daily precipitation, seasonal variations in precipitation, evapotranspiration rates, frost days, terrain slopes, soil depth, soil fertility, soil chemistry, soil drainage, and soil texture. These factors have been combined to precisely delineate the spatial patterns of agriculturally productive land for many of the world's most important crops and crop types (grains, root crops, oil crops etc.). Taken together, these measurements allow for a far more detailed yet at the same time extensive consideration of variations in world regional agricultural potentials.

Although developed primarily to estimate potential world food supplies and mitigate famine, this data can also be used to show that there are indeed dramatic differences and clear patterns to world regional potentials for food production. This is important because some, such as Blaut (1993, 2000, who in turn is frequently cited, e.g. Robbins 2003) reject development arguments that are based on differences in agricultural productivity. Blaut selectively uses data to refute earlier arguments of this

[128] The Global Agro-Ecological Zones (GAEZ) from the Food and Agriculture Organization of the United Nations (FAO) with the International Institute for Applied Systems Analysis (IIASA).

type; more modern, detailed and spatially extensive data clearly shows that Blaut's arguments are either incorrect or misleading (i.e., there are, as Blaut claims, areas of productive tropical soils, but overall there are serious problems with and drawbacks to tropical agriculture). Many parts of the world clearly do suffer from important limitations and temporal instabilities (Davis 2002) of food production potential, while others have unusually high and stable capacities for food production.[129] Increasingly, work such as Sachs 1997, Gallup 1998, Masters and McMillan 2000, Masters and Wiebe 2000, and Masters and Sachs 2001 show mechanisms whereby food production stability and potential (and other geographic factors) directly and indirectly impact social and economic development outcomes, through affecting average lifespan (and thus also investment in education), the accumulation through early agricultural productivity of the minimal capital necessary for improvements in infrastructure, education, and health initiatives, the lack of agricultural surpluses for trade, which has knock-on consequences on the development of policy choices and institutional development (such as banks and legal institutions) and so on. In addition to these arguments, recent extensive yet detailed agricultural data may be relevant to state competition and the second factor – a large number of states – necessary for mercantilist policies.

There are many factors that likely are important in influencing the number of states within a region. However, given historical limitations on centralization due to transport cost and communication speed limitations in the preindustrial period, *ceteris paribus* the greater the spatial size of the ecumene, the larger the number of states (on the size limitations on states, see Dahl and Tufte 1971).[130] Midlarsky (1995) similarly theorizes on the relationship of the distribution of rainfed agriculture and political

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[129] Based on modern soil, terrain and climate data the GAEZ researchers note 'that more than three-quarters of the global land surface (excluding Antarctica)… suffer rather severe constraints for rain-fed cultivation. Some 13 percent is too cold, 27 percent is too dry, 12 percent is too steep, and about 65 percent are constrained by unfavorable soil conditions (percentages do not sum up to 100, because different constraints coincide in some locations). The analysis concludes that only 3.5 percent of the land surface can be regarded to be entirely free of constraining factors. Only for some sub-regions in Europe did the share of essentially constraint-free conditions reach 20 percent and more.'

Similarly, Davis (2002) finds that Europe is virtually the only part of the world not seriously negatively affected by the ENSO oscillation variations in weather so strongly detrimental to stable agricultural production, especially in Africa and Asia.

[130] Taagepera 1978 provides an interesting overview of the relative size of *empires* throughout history, although empires are politically distinct from states, which are in turn politically different from other political types; see especially Spruyt 1994 for a relevant discussion of these classifications and their significance to the discussion here.

development. Extensive rainfed agricultural in effect spreads the means of production evenly across a world region, making an 'exit point' for escape from centralizing agrobureaucratic empires possible (Gellner's [1988] term, although he refers to the possibility provided by sustenance by trade rather than agriculture). This exit point from centralizing neighboring states is simply not an option for regions that have little ability to feed themselves and maintain the military force historically known to be required to avoid forceful incorporation into neighboring states.

The GAEZ data (an example is shown in Figure 8.4 below) shows the contiguous extensive agricultural areas that formed the agricultural ecumenes of world regions (compare to Lewis and Wigen's world regions in Figures 6.2 and 6.3). Several of these are particularly vast, as in North America, South America, sub-Saharan Africa, western Eurasia and East and South Eurasia.

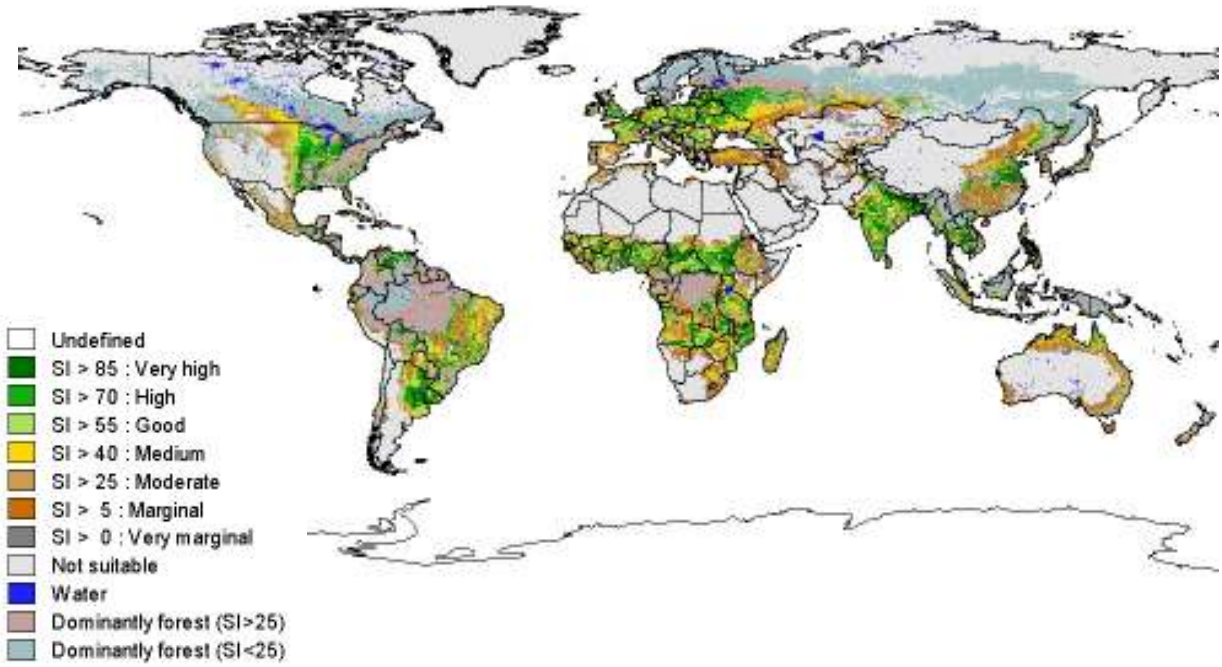

Figure 8-4 Suitability for Rain Fed Crops Excluding Forest Ecosystems[131]
Source: Global Agro-Ecological Zones (GAEZ) from the Food and Agriculture Organization of the United Nations (FAO) with the International Institute for Applied Systems Analysis (IIASA)

[131] This includes maize, a non-Eurasian crop; however, (with inspection of related GAEZ data) it is representative of the relative fertility of the regions concerning the main crops, wheat, barley and rye in Europe, and rice and millet in China; if anything, China and India are overrepresented with the addition of maize as they are better suited to maize production than Europe (even including the Mediterranean; see the appropriate GAEZ plates on the IIASA website).

It is clear that the west-Eurasian agricultural ecumene is among the richest and most extensive in the world,[132] rivaled primarily by sub-Saharan Africa and the Americas (especially by North America among temperate agricultural areas) in size.

Historically, it is known that a Eurasian region (western Eurasia) would colonize or politically control much of the non-Eurasian world (and other Eurasian regions to a degree). This is attributed to a number of factors such as early Eurasian leads in state formation and technology and exchanges of disease favorable to Eurasians (diseases which are also indirectly attributable to Eurasian food production via early and widespread domestication of livestock; see Crosby 1972 and 1986). Thus the other regions sometimes cited as having potentially had the capability to do what western Eurasian societies did are also Eurasian societies, chiefly China, India, and the Middle East. However, among these the vast extension of productive agricultural land is greatest in western Eurasia (Figure 8.5 below). Historically it is known that numerous strong states would develop in western Eurasia, and that political and military competition from throughout this vast agricultural ecumene (from Anatolia, North Africa, the British Isles, the Scandinavian peninsula, the vast eastern plains - Russia, Poland, Hungary and so on) would contribute to the strength of states in the region as a whole (Gellner 1997; Goudsblom 1996; Spruyt 1994; Tilly 1990). There seems to have been greater opportunity within western Eurasia for extreme state competition to develop than in any other Eurasian ecumene.

[132] The projection used here, the 'geographic' or 'latitude-longitude' projection, while not an equal area projection, nevertheless does not distort area nearly as much as the Mercator and some other common projections. Comparison with an equal area projection shows that the western Eurasian agricultural ecumene is still by far both the largest in Eurasia and the largest in a temperate zone.

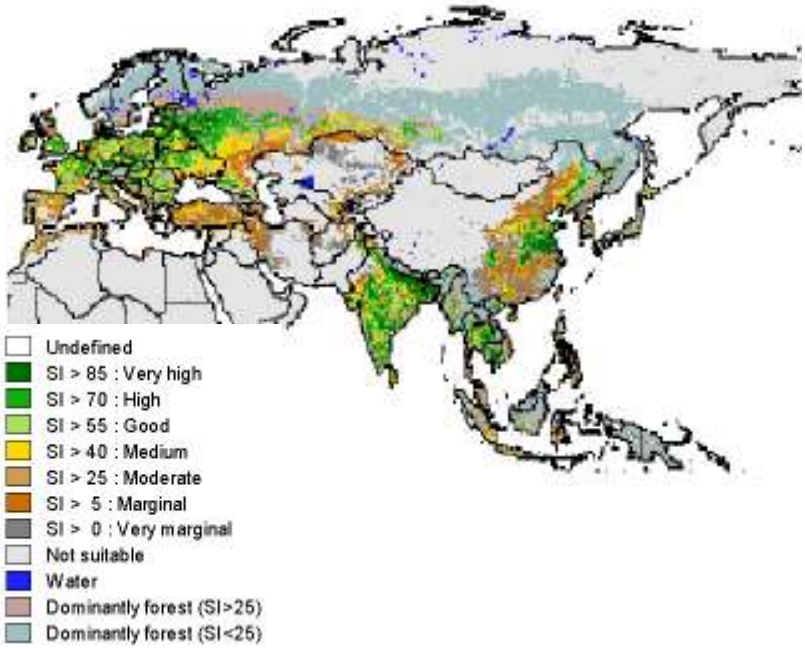

Figure 8-5 Eurasia - Suitability for Rain Fed Crops Excluding Forest Ecosystems
Source: Global Agro-Ecological Zones (GAEZ) from the Food and Agriculture Organization of the United Nations (FAO) with the International Institute for Applied Systems Analysis (IIASA)

The last statement above alludes not just to the *number* of states, but to the *strength and centralization* of states. But can this factor also be better considered empirically now than in the past? The third factor mentioned as important for a geography of mercantilism is the distribution of strong, centralized, bureaucratically effective states. As previously mentioned, this factor is partly a *result* of the first two factors: trade is associated with quality institutions, while state, and especially in the pre-modern era of state formation, military competition is associated with centralization and bureaucratization (Tilly 1990).

It was shown in Figure 8.4 that there are a number of world regions with extensive areas of productive agriculture, and noted that these areas are associated with early state development and with varying subsequent degrees of political fragmentation. But is there a way to empirically gauge the *overall* political competition in a world region? Were these systems not just of many, but of *strong* competing states? It may be possible to use a measure of the long-term historical strength of states developed to test the relationship between state antiquity and economic growth in Bockstette,

Chanda, and Putterman (2002).[133] Using the world regions from Lewis and Wigen the Bockstette et. al. (2002) measure of state strength in a region for all of the states in the region can be added together.

As a combined indicator representing both state strength and the potential for state competition (number of states interacting in a region) the 108 measures for historical state strength for Afro-Eurasian countries can be divided into the eight Afro-Eurasian world regions of Lewis and Wigen gives the following, which can be viewed as an objective empirical estimate of state competition potential.

Western Europe	**13.9**
W Asia/N Africa	**9.0**
Sub Saharan Africa	**8.6**
Southeast Asia	**5.4**
Eastern Europe	**5.4**
East Asia	**3.9**
Central Asia	**3.8**
South Asia	**3.6**

However, (at different time periods) there were greater and lesser degrees of interaction between world regions. The *major* historical divisions Lewis and Wigen make are first between the 'new worlds' and Eurasia, and within the vast Afro-Eurasian area, between Sub-Saharan Africa, East Asia, and the rest of Eurasia. (There are then increasingly less important divisions between South Asia, Europe, and East and West Europe). With time the trade and cultural connections between East, Southeast, and South Asia would increase while at the same time the connections

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[133] Bockstette, Chanda and Putterman (2002) divide the period from 1 to 1950 C.E. into 39 half centuries. They rank each half century based on three questions: '1. Is there a government above the tribal level? (1 point if yes, 0 points if no); 2. Is this government foreign or locally based? (1 point if locally based, 0.5 points if foreign (i.e., the country is a colony), 0.75 if in between (a local government with substantial foreign oversight); 3. How much of the territory of the modern country was ruled by this government? (1 point if over 50%, 0.75 points if between 25% and 50%, 0.5 points if between 10% and 25%, 0.3 points if less than 10%). Answers were extracted from the historical accounts on each of 119 countries in the *Encyclopedia Britannica*. The scores on the three questions were multiplied by one another and by 50, so that for a given fifty year period, what is today a country has a score of 50 if it was an autonomous nation, 0 if it had no government above the tribal level, 25 if the entire territory was ruled by another country, and so on." We then combined the data for the 39 periods, experimenting with different ways of "discounting" to reduce the weight of periods in the more remote past.' (Bockstette *et. al*. 2002, 346).

between East and West Europe, the Mediterranean and North Africa (at times) would increase. If we take the varying degrees of interaction between regions into account (again using Lewis and Wigen, the major divisions in sociopolitical interaction were between East Asia, South Asia, and west-Asia/Mediterranean) we get something like the following:

Sub-Saharan Africa	**8.6**
East/South/ Southeast Asia	**12.9**
Europe (East and West)	**19.3**
Europe/+Mediterranean	**24.1**

On this measurement, which combines several key considerations, it is clear that western Eurasia had by far the greatest potential for state competition and competitive policies to develop.[134]

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[134] Sub-Saharan Africa may seem to be especially problematic. It has a vast agricultural ecumene comparable to that of western Eurasia (even when taking into account large areas of dominantly forest cover that significantly reduce agricultural land in the Americas and Sub-Saharan Africa). However, here is a good example of where rejections of environmental influence such as those of Blaut (1993), Sluyter (2003) or Robbins (2003) are problematic: They often reject to single factors in a piecemeal fashion. Yet in complex systems, of which society is a supreme example, it is widely emphasized and accepted that it is the *interplay* between factors that are often of primary importance. In Africa, the difficulty of the environment is reflected in the unusually low population densities of the continent (which preexist and are largely spatially unrelated to the slave trade – see Bairoch 1993 and Maddison 1995 and 2001; the low population density of Africa is often unnoticed because many map projections obscure the vast size of Africa relative to other world regions, increasing the likelihood of failing to notice how relatively small African populations are given the continent's size). Also, as evident in Figure 8.2, the water transport potential in Africa is exceptionally low; none of the great African rivers are easily navigable into the interior, many dropping off the great African plateaus, a fact that combines with the low degree of coastal indentation and few natural ports to make water transport very difficult in Africa (Sowell 1996, 1998; Mellinger, Sachs and Gallup 1999). Although this is frequently remarked upon, it is the *interaction* of *multiple* factors such as transport costs, agricultural productivity, demographic factors, the biogeography of disease, and state and institutional development and other factors that is important, a subtle and complex interrelationship that cannot be understood by looking at any of the relevant factors on their own. [continued next page]

These measures are of course rough estimates. But they do allow for an objective and empirical measure, as opposed to many of the vague statements and assertions one finds in the historical, economic, political and development literature, of the degree of state competition within regions. I plan to further refine and quantify these empirical measurements. Overall, it seems that there was a much greater potential for state competition in the vast western Eurasian agricultural ecumene than in any other region in the world. As has been argued by so many social scientists from different political and disciplinary perspectives, this seems to have been a crucial factor in European development. It was an impetus towards trading post and colonial expansion, increasing the likelihood that it would be a western Eurasian power that would first stumble upon the then unknown extra-Eurasian lands. This, as Blaut 1993,

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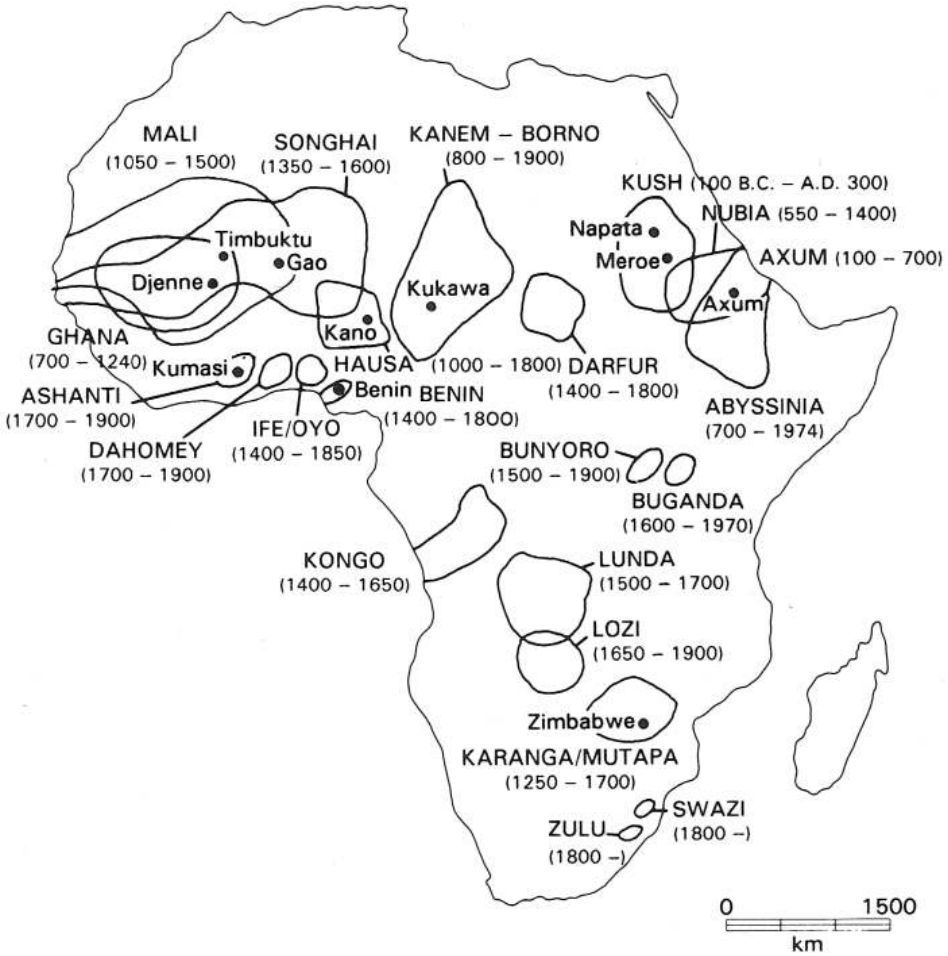
Of particular relevance here, the number of historically strong states in Africa is much smaller than observations of the modern artificially imposed European state structure might suggest. Given their wide spatial separation (Stock 1995, below) and the underappreciated vastness of the Sub-Saharan region, they likely had far less interaction than states in many other Eurasian regions, and the Bockstette et. al. measure likely overestimates the overall level of state strength and interaction in Sub-Saharan Africa.



Major Precolonial African States and Empires
Source: Stock 1995, p. 62

Frank 1998, Pomeranz 2000, Acemoglu et. al. 2003, 2005 and others have argued, had profound knock-on effects on European political, social, demographic, technological, and institutional development with effects that are still felt today, and are especially apparent in global *spatial* patterns of development today.

Conclusion

The current point of the previous empirical section has not been to develop these empirical arguments fully and in detail. Rather, the goal is to show that there exists better data – more extensive, more detailed, more accurate, and more appropriate to the questions asked in development studies – to bring to bear on questions of uneven development. Moreover, visualizing this data using descriptive statistics and maps is especially useful. This section has considered some of these empirically supported possibilities for considering the development of the spatial distribution of the mercantilist policies so closely associated with European expansion and western industrialization, using more data than has been used in the past, visually where possible.

CHAPTER 9
CONCLUSION AND DISCUSSION

Conclusion

The goal of this dissertation is to better understand how initial conditions play a special role in the explanation of contingent and irregular outcomes, including, in the form of geographic context, the special case of uneven development in the social sciences. Eight chapters are devoted to this question, which might be considered to consist of two parts, the first theoretical and the second considering how the ideas from the first half of the dissertation might be applied to empirical studies of development.

The structure of the latter half (Chapters 5-8) of the dissertation is relatively straightforward. Chapter 5 considers the relation of the theoretical arguments in the first half of the thesis (concerning the importance and role of initial conditions in 'contingent' outcomes) to the empirical study of uneven development, Chapter 6 discusses methodological implications of this argument, and Chapter 7 then considers how these ideas might be applied to recent research on uneven development with the 'reversal of fortune' argument from Acemoglu, Johnson and Robinson 2002 as a primary example. In doing so Chapter 7 thus serves both as an example of how the earlier theoretical concepts might be applied and as the beginning of a future research agenda. Further possibilities for future empirical and theoretical work are considered in Chapter 8.

The first half of the dissertation is more abstract than the second half. This was not the original intention for the dissertation, which was initially meant to be a straightforward empirical study of uneven development, either attempting to formulate better theories of development, gather better data on development, or both. However, with time it seemed that much of the dissatisfaction and general feeling that there is a lack of progress in development studies (Chapter 1) was not necessarily due to development theories or data *per se*, although these are highly contested, but with more fundamental problems related to explanation. In particular, there seemed to be repeated allusions made to singular causation in one form or another (often with the

converse wording, i.e., rejecting 'regularity' explanations rather than explicitly calling for singular causation explanations) in the various strands of literature on uneven development, specifically in discussions of perceived failures of development studies. These included frequent references to concepts such as 'contingency', 'realist' explanations of location (in the geography literature), critiques of 'regularity' accounts of explanation (citing Bhaskar or Cartwright), and a trend among economists and historians toward utilizing what until recently were largely rejected geographic factors and related discussions of initial conditions.

It seemed more useful to attempt to better understand this emerging pattern in location/development studies rather than simply add to it. *Why* does the concept of 'contingency' arise so often in the discussion of location and uneven development? And what, precisely, is even *meant* by the word 'contingency', which seems conspicuously ill-defined, often seeming to be chosen in order to elide rather than clarify some crucial (and perceived as distasteful) assumptions? *How*, precisely, are counterfactual or 'critical realist' approaches to explanation supposed to help in explaining uneven development? Why do both critical realist and orthodox scholars, presumably in disagreement on basic issues of explanation, nevertheless *both* frequently emphasize contingency? Why has there been a marked trend towards discussions of 'initial conditions' by many orthodox economists? Relatedly, why are geographic factors being relied on for explanation by mainstream scholars in recent years despite the historical association of these with simplistic, racist, or imperialist views?

Exploration of these questions began somewhat independently of each other. The study of open system arguments by critical realists following Roy Bhaskar and in the philosophy of science following Nancy Cartwright resulted from noting the link between explanations of location, Bhaskar's work, and the concept of contingency made especially by Sayer (2000). The idea that initial conditions could be equated with exogenous factors stemmed from the philosophy of science articles by McAllister (1999 and 2004). Linking initial conditions and open systems arguments (Chapter 2) then became an obvious possibility, especially when the fact was noticed that 'open' systems *necessarily* imply some kind of 'exogenous' factor and vice versa. Making these links gradually helped reveal the importance of renewed emphasis on the relationship between initial conditions and explanation, especially for the explanation of spatial irregularities such as uneven development.

Chapter 3 of the dissertation deals with the concept of contingency. As noted, this is in part simply because the concept of contingency recurs time and again, often at critical junctures, in discussions of uneven development and location, from scholars of all types, including Marxists, critical realists, orthodox economists, and historians. More importantly, I wanted to show that one possible—and at least arguably 'correct' definition of contingency is that it is simply a class of open-system/exogenous-factor interaction (the class being where the 'system' is defined by the observer's knowledge, so that the interaction of the exogenous factor *seems* contingent because of the observer's ignorance of the impending intersection or conjuncture of the two systems; see Chapter 3). Crucially, *this places the concept of 'contingency' within the scope of the theory argued in Chapter 2*. 'Contingency', then, is so frequently mentioned in discussions of uneven development because it is a result of the same process of exogenous-factor/open-system interaction created by irregular initial conditions discussed in Chapter 2. This, in turn, is critical in linking these philosophy of science arguments on explanation to empirical studies: When contingency is mentioned in location or uneven development it is an indicator that the argument will need initial conditions for resolution in the ways discussed in Chapters 5 and 6.

Further Considerations and Objections

Although potential objections to a laws plus initial conditions (L+IC) approach to explanation have been addressed in previous chapters, additional possible objections deserve special mention. These include criticisms that explanations from initial conditions are unfalsifiable 'just so stories', and a constellation of objections related to reductionism (including emergence/complexity and predictability/utility). The dissertation concludes by considering these objections.

Unfalsifiable, 'just so' stories

Criticism: Explanations from initial conditions are non-falsifiable – mere 'just so' stories.

The confusion regarding the importance or lack of importance of this critique rests again on the failure to recognize the importance and precise role of initial conditions in explanation.

The role of *laws* in explanation is in one sense straightforward - if there is a case, even a single case - that contravenes a purported law, then the law is in error in some way. By the very definition of regularity accounts of laws, falsification is correct in this case, and it is clearly a powerful concept in its ability to overturn an entire theory with a single counter fact.

The argument for falsifiability is correct and useful *for the aspect of explanation related to laws of nature.* The problem, as we are at pains to show in this dissertation, is that laws 1) came to dominate the concept of explanation (by both proponents *and* opponents of laws of nature) while 2) the crucial role of initial conditions was largely lost in debates on explanation by all sides. Although falsifiability is a crucial concept for the part of explanation related to laws it is only trivially important to the aspects of explanation related to initial and antecedent conditions. In contrast to the role of laws of nature in theories that are sometimes falsified 'spectacularly' the role of initial and antecedent conditions is piecemeal and tedious. Given some set of initial conditions, the few laws of nature tell how a system will evolve, but besides knowing the laws of nature, learning the story of that system is a question of large amounts of empirical data, no one bit of which is especially important. Any bit of the large amount of data about a system found to be 'wrong' will just adjust the explanation slightly in most cases.[135] Adjusting the explanation ('the story'), however, opens explanation from initial conditions to the criticism that it is just one big 'just so' story.

Crucially, however, there is a *logical* mistake in the just so story criticism of explanations from initial conditions. Critics have lost sight of what the just so story criticism is meant to do. In any historical explanation, there are virtually endless possible just so stories that might be told to explain something. Pointing this out usefully makes clear that just because a story *seems* to explain something, there are many *other* possible explanations. The story one has initially chosen is not necessarily, nor even *probably*, the correct story.

However, what the just so story criticism does *not* do is show that an explanation is necessarily wrong *just because it is a just so story*. Unfortunately, this is often forgotten, with theories being rejected based on the just so story criticism. Out of the

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[135] For example, finding out there are more planets in the solar system (as with the discovery of Pluto) or that the rings of Saturn are made of one mineral rather than another most likely does not overturn any laws of nature, but rather tells us that the antecedent conditions of the solar system were slightly different than previously thought.

millions of possible stories, *whatever the correct explanation in the historical sciences turns out to be, it will also* always *be a just so story*. Crucially, therefore, it is simply not correct to reject an explanation for being a just so story. The just so story criticism only properly serves as a warning to not embrace too readily a story (because there are many other possibly correct stories), and to check the facts carefully before accepting it.

We learn material facts about the world precisely to reduce the millions of possible just so stories to a manageable number of plausible stories. The more facts, the fewer plausible stories. For example, the dinosaurs seem to have disappeared around 65 million years ago in the K-T event. There are endless possible reasons for this. But with the acquisition of certain material facts – iridium layers found by geologists, the Yucatan crater and so on, one just so story (a large asteroid impact) seems to be the correct story. The K-T event explanation is a just so story; it seems to be the right one, however, winnowed out of many possible just so stories by learning about known states of the world at certain time periods.

Reductionism

Closely related to the criticism of a laws plus initial conditions approach to explanation being deterministic is the criticism that it is reductionist.[136] As with determinism, there is also often a moral element to the rejection of reductionism. For example, one historian speaks of a fear of the moral implications of the role of 'ecological reductionism' (rather than 'determinism') in 'letting people off the hook for the history they have wrought' and allowing them 'to evade the question of politics' (Blackmar 1994 in Steinberg 2002, 804). However, if reductionism is morally rejected based on its association with determinism then the same objections to the moral rejection of determinism discussed in Chapter 4 equally apply.

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[136] Determinism and reductionism are frequently used in close conjunction or even synonymously with each other (it would seem correctly – no attempt is made here to 'rescue' reductionism through denying its association with determinism as is frequently done), including in the social sciences. For example: 'Catching the first whiff of sociobiology, many sociologists often object, in an almost "instinctual" manner (Ellis 1996), to "reductionism" and "determinism"' (Machalek and Martin 2004, 467).

Similarly: 'One way of explaining social change is to show causal connections between two or more processes. This may take the form of determinism or reductionism, both of which tend to explain social change by reducing it to one supposed autonomous and all-determining causal process.' (*Encyclopedia Britannica*, 'Social Change', 2007)

In addition to the moral objection to reductionism, however, there is a *practical* objection to reductionism, related to emergence. This can be based either on a strong (metaphysical, ontological) view of emergence or on a weak (epistemic) view of emergence. The strong view of emergence is that there are emergent properties which are ontologically real (in this case, referring to society), and cannot, even in theory, be reduced. The weak emergence objection is that even if there is not ontological emergence, society is still far too complex (with 'weak' or non-ontological emergent properties) to be studied in a reductionist manner.[137]

As far as the argument for ontological emergence, there is simply little evidence that there is such a thing. For example, Silberstein and McGeever (1999), in a careful survey, find that there do not seem to be cases of ontological emergence in the classical world – in *every* case they consider there are hidden factors that can, at least in theory (metaphysically), account for what appears to be ontological emergence. Nevertheless, they *do* find hope for ontological emergence, as have many others in the past, in quantum mechanics. However, there are both logical and scientific problems even with this much narrower claim for ontological emergence. Logically, it simply is not valid to rely on a lack of knowledge in one field (physics has studied smaller things until it has reached the limit of current understanding) to make a positive assertion in another, i.e., that because we do *not* understand quantum mechanics fully we *do* know that society is 'a reality sui generis, a distinctive and emergent ontic

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[137] What might be called *theoretical* reductionism is often confused with ontological reductionism (and thus as the opposite emergence) in the social sciences. Galanter 2002 provides a good example of this common view of (theoretical) reductionism, which 'refers to any attempt to describe and explain a field of study solely within the paradigm of another, possibly incommensurable, field of study' (Galanter 2002, 2). He also, with usefully informal descriptions, correctly distinguishes this from true ontological reductionism and its methodological counterpart methodological reductionism, the first which 'posits views of hierarchical being such as, for example, the common scientific understanding of matter as molecules made of atoms which in turn are made of subatomic particles and so on' and the second which 'suggests a parallel method of exploration whereby large systems are iteratively broken into smaller systems until one finds a set of simple systems that can be understood and explained' (2).

Roger Sibeon provides a good example of the way in which social scientists often actually mean theoretical reductionism in their discussions of reductionism: 'A *reductionist* theory is a theory that attempts to explain social life in terms of a single, unifying principle of explanation (Lyman and Scott 1970:16; Hindess 1986a, 1986b, 1988) such as 'rational choice', the 'interests of capitalism', 'patriarchy', or 'globalisation'.' (Sibeon 1999, 317). Yet explanations of social outcomes based on rational choice, capitalism or globalization are by no means necessarily, nor even likely, ontologically reductionist; indeed quite the opposite as they most likely would not argue that the macro-phenomena of capitalism or globalization (for example) are fully reducible in theory to individuals and especially not ultimately to biology, chemistry, and physics.

plane' (as Bryant describes the common social science view, 2001, 468).[138] More importantly, as a closed system the universe as a whole unfolds deterministically according to Schrödinger's equation (Weinberg 2001, 118-119; Schlosshauer 2004); as discussed in Section 2.5, given the ubiquity of decoherence *within* this deterministic system (i.e., the fact that there are no true closed systems within the universe) there is no clear reason why metaphysical reductionism is incorrect. (In a more recent work Hüttemann 2005 also finds quantum mechanics to be reductive).

However, even if emergence is not truly ontological, *weak* (epistemic) emergence can still be viewed as a problem. Explaining through reliance on laws and initial conditions can be viewed as a reductionist strategy that is highly inappropriate for something as profoundly (epistemically) emergent and complex as society.[139] However, as emphasized in Chapter 5, this is precisely why inherently irregular initial conditions, or geographic factors as exogenous factors in the study uneven development, are especially useful. They do not reductively explain, or even attempt to explain, everything about society. Rather, they take the circularity out of proposed answers to the 'uneven' part of the question of uneven development through their role in anchoring complex social processes to real world locations (Chapter 5).

The utility of this anchoring capability relates to reductionism: We do not need to reduce a problem further than the level we are satisfied with as an explanation. What does this mean? Consider again the earlier discussion of just so stories, where the large asteroid impact theory of the K-T extinction event is seen as a just so story that nevertheless seems to be a highly satisfying answer to the problem of the disappearance of the dinosaurs. It is satisfying because it matches certain material facts that winnow it out from all the other millions of possible just so stories concerning their disappearance.

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[138] Nor does the argument that somehow quantum indeterminism is responsible for the non-reducibility of the mind help; as Marcel Weber notes after a careful survey of this question, 'for the time being it is necessary to set the record straight on indeterminism in neurobiology. At present, its prospects are not good' (Weber 2005, 672). Moreover, as noted in Chapter 2, even if there were ontological chance in physics, because of 'asymptotic determinism' this may not 'percolate up' and make the biological realm indeterministic, nor ontologically emergent (see Millstein 2000 and 2003).

[139] The close relationship between all of these concepts - prediction, utility, explanation, determinism, reductionism - is evident in Weinberg's observation that '[determinism and reductionism] tend to go together because the reductionist goal of explanation is tied in with the determinist idea of prediction (Weinberg 2001, 118).

However, and crucially related to reductionism and explanation, *the story one tells from initial conditions does not need to be narrowed down completely*. There are still a number of possible variations - refined 'stories' - that could be told that fit the facts known about the K-T event. Yet a broad 'asteroid explanation' is nevertheless thought to be a highly satisfying explanation of the K-T extinction event. The millions of just so stories only need to be reduced and winnowed to the degree of precision we are satisfied with as an explanation.

Similarly, we do not need to be fully reductionist in the study of society to achieve satisfying *spatial* explanations. There is clearly no way methodological individualism, sociobiology or other reductionist approaches to explanation in the social realm can fully 'explain' society in all its rich detail and contingent outcomes. However, in the ways discussed in Chapter 5, material facts in the form of inherently spatially varying initial conditions *can* provide answers that break the 'circular endogeneity' in the study of uneven development, affording uniquely satisfying answers to long-held questions concerning uneven development.

APPENDIX A
TABLE OF SETTLER MORTALITY, URBANIZATION, AND CURRENT INSTITUTIONS BASED ON ACEMOGLU, JOHNSON AND ROBINSON

This table is the same as Table 7-1, except with the five rows of GNI in Table 7-1 replaced with the AJR 2002 measure of institutional quality. There is very little change between this table and Table 7.1 (which is also further evidence of how closely measures of institutional quality covary with economic indicators). However, we include this table as well as it is still interesting to see the data from an institutional rather than economic perspective. We divide the AJR cases (former colonies) by the world regions discussed in Chapter 6 (we subdivide 'Latin America' based on the degree to which the pre-Colombian peoples influenced post-colonial countries). The data within each column is further divided into three columns representing the degree of settler mortality (AJR 2001) and into three rows representing categories of institutional quality (Low, Medium, and High). Below each case is a number representing the data on urbanization in 1500 (AJR 2002a) which AJR used as a proxy for development in 1500.

Table A-1 Settler Mortality, Urbanization, and Current Institutions
(next page)

		Sub-Saharan Africa			Aztec and *Inca*			Other Latin America			South/East Asia			N. Africa/Mid East			Settler Colonies		
		Hi S.M. 201+	**Med 200-50**	**Low 50-0**	**Hi 201+**	**Med 200-50**	**Low 50-0**	**Hi 201+**	**Med 200-50**	**Low 50-0**	**Hi 201+**	**Med 200-50**	**Low 50-0**	**Hi 201+**	**Med 200-50**	**Low 50-0**	**Hi 201+**	**Med 200-50**	**Low 50-0**
Poor Inst. (3.5-6.0)		Sierra Leone <3.2 Congo <3.2 Madagascar <3.2 Niger <3.2 Mali <3.2 Nigeria <3.2 Burkina Faso <3.2 Uganda <3.2 Zaire <3.2 Angola <3.2	Senegal <3.2 Sudan <3.2			*Bolivia 10.6* *Peru 10.5* El Salvador Honduras 9.2 Nicaragua Panama Guatemala 9.2			Haiti 3.0	Guyana 0.0			Bangladesh 8.5			Ethiopia			
Med. Inst. (6.1-8.0)		Cote D Ivoire <3.2 Togo <3.2 Ghana <3.2		South Africa <3.2		*Colombia 7.9* *Ecuador 10.6* Costa Rica 9.2 Mexico 14.8			Dominican Republic 3.0 Paraguay 0.0 Trinidad and Tobago Venezuela 0.0 Brazil 0.0 Jamaica 3.0 Bahamas Chile 0.0			Indonesia 7.3 Pakistan 8.5 Vietnam 7.3	Malaysia 7.3 Sri Lanka 8.5		Algeria 14.0 Egypt 14.6 Morocco 17.8	Tunisia 12.3		Argentina 0.0 Uruguay 0.0	
Good Inst. (8.1-10.0)		Gambia <3.2										Hong Kong 3.0 India 8.5	Singapore 3.0						Australia 0.0 New Zealand 3.0 Canada 0.0 U.S.A. 0.0

APPENDIX B
GEOGRAPHY AND PREEXISTING INSTITUTIONAL VARIATION IN EUROPE

As discussed in Chapter 5, Donald Meinig summarizes two major questions crucial to geographic understanding: (1) why do major cultural patterns and movements begin where they do (the problem of the 'culture hearth'), and (2) how do they spread to other peoples and areas (a problem of spatial diffusion)? (Meinig 1978, 1189).

Chapter 7 of the dissertation focuses on economic work on the New World by Engerman and Sokoloff and on former colonies by Acemoglu, Johnson, and Robinson. Colonization of course deeply affected the institutional development of these regions, and as Meinig emphasizes, this means that not only is the *spread* of peoples crucial to understanding modern geographic patterns of development, but also the *original patterns* of social development in the region from where the spread began.

The purpose of this appendix is to demonstrate possible directions future research might take (and the further use of mapped data as discussed in Chapter 6) as well as explore in more detail various discussions from Chapters 5-7. The appendix shows how geographic factors can be useful in considering the first of Meinig's two questions above. It explores how geographic factors influenced the spatial pattern of institutional and political development *within* Europe, which, with the subsequent spread of European influence out of Europe in turn deeply impacted economic and political development at the global scale. Data from some disciplines are considered using theories from other disciplines to explore the role of geographic factors in the spatial patterns of social development.

Land, Water, and Institutional Amplification

Unlike many factors that vary across a continuum, transport costs are interesting because they are sharply divided into two classes – high land transport costs and

relatively low water transport costs. This variation occurs in a natural distribution of coastal, inland, and riverine patterns. The association of water transport with patterns of population density and urbanization has frequently been made. More recent are abstract spatial theories that predict that spatial effects alone can give rise to a sharp divide between more and less industrialized regions. These theories can be combined, and the resulting patterns amplified still further in accordance with theories of institutional development that predict cumulative economic effects from patterns of social behavior such as high and low social capital.

Fox's Thesis

Edward Whiting Fox, in *History in Geographic Perspective: The Other France* (1971), lays out an argument implicitly based on this simple table:[140]

		Control		**Commerce**
Land		**easy**		**hard**
Water		**hard**		**easy**

Table B-1 Basis for Fox's Two Societies (1971)

Fox sees two societies in France, one centered on Paris and Versailles, an agricultural society focused on an interior dotted with thousands of small towns a days ride apart, limited in their trade by the high cost of land transport (reminiscent of the ideas of Christaller [1933] and Lösch [1940][141]), and a 'second France' made up of market centers on international trade routes such as Lille, Lyons, and Strasbourg (Lille and Strasbourg are also near or on important rivers), but most of all made up of the rim of port towns, Marseille, Bordeaux, Nantes, Saint-Malo, and Rouen. The patterns of distribution of land and water imposed different commercial activities and military potentials in France, which in turn led to 'two Frances, geographically bound

[140] Table is from Tilly (1989, 158).

[141] The extreme isolation of medieval villages is well described in *Life in a Medieval Village* (Gies and Gies 1991).

together but economically and socially separate and politically antagonistic' (Kindleberger 1978, 183). In a later work Fox expands this view to Europe:

> Most surveys of [Europe from the early modern period to the present] focus upon the rise of the nation state, chronicling the pursuit of military power and the consolidation of territory under central governments. In this book, however, these developments are seen as only one strand of the story; equally important in shaping the modern world was an expanding pursuit of commercial wealth, which knit port cities together into a growing community with an organic existence of its own…
>
> The history of the commercial community is comparatively difficult to follow, partly because it lacked the clearly defined territorial base and the formal governmental structure of the nation state. Instead it consisted of a widespread and complex network of waterborne communication systems connecting islands and the fringes of the continental masses. Although governments took part in this trade in various ways, it was essentially and increasingly a private undertaking, which enriched the port cities rather than the administrative capitals of territorial states. Oriented toward the sea, the port cities characteristically had little integral relation to the land- based governments of their hinterland except where they served as vulnerable objects of forceful exploitation or willing sources of capital investment (Fox 1991, 1-2).

Braudel (1979/1981) similarly notes that 'only certain regions were urbanized in depth, thus distinguishing themselves from the rest and playing a vitalizing role…Merchants, craft guilds, industries, long-distance trade and banks were quick to appear there, as well a certain kind of bourgeoisie and even some sort of capitalism. The destinies of these very special cities were linked not only to the progress of the surrounding countryside but to international trade' (511). Braudel describes the same commercial society Fox asserts developed, and how its emergence is related to commercial cities. The key observation of Fox is that the 'certain regions…playing a vitalizing role' that Braudel mentions were those with high water transport potentials.

The role Fox asserts is not just economic, but social and institutional as well, with an Atlantic oceanic community forming across national boundaries throughout

Europe. The historian Michel Mollat du Jourdin (1993) describes this trans-European commercial development:

> The presence of Italian and Iberian merchants on European commercial sites had a decisive influence on the formation of an international commercial environment at the end of the Middle Ages; French, Dutch, English and Germans joined each other there. The practices of fitting-out, of financing and of insurance experienced at that moment a beginning of unification, the progressive adoption of Italian techniques by Germans, for example. Correspondence between merchants' bank regulations from market to market and from port to port give proof of this. Family alliances were formed. Networks of cousins stretched from Seville to Genoa, from Lisbon to Antwerp, from Bilbao and Burgos to Nantes and Rouen, as well as from Florence, Genoa and Leghorn to London and Southampton, and from London to Hamburg, Bremen, Lübeck and Gdańsk. A Europe of merchants was formed, capable of not turning up its nose at political conflicts, but of living with them and surviving them (229) .

This passage bears close resemblance to Fox's idea of an oceanic trading community that was very different from continental states. However, as Fox emphasizes, the networks of commercial development Mollat du Jourdin discusses were far from evenly distributed. They were highly concentrated in the areas of Europe with the greatest transport potential – not just areas with highly indented coasts, but especially on areas with a confluence of ocean navigable rivers and coast (Switzerland, a bottleneck of mountain passes between poles of this oceanic/riverine commerce nexus, would also be integrated into it – to this day Switzerland actually has some of the lowest transport costs in the world, and Austria only slightly higher (Radelet and Sachs 1998, 5).

Water Transport and Political Development

Transport costs receive mention in many aspects related to urbanization and social change, but usually in passing or without emphasizing the land-water dichotomy and potential effects stemming from this difference. One early and important exception

was Adam Smith (1776), who placed strong emphasis on the same effects of the difference in water and land transport that Fox focuses on:

> As by means of water-carriage a more extensive market is opened to every sort of industry than what land-carriage alone can afford it, so it is upon sea-coast, and along the banks of navigable rivers, that industry of every kind naturally begins to subdivide and improve itself, and it is frequently not till a long time after that those improvements extend themselves to the inland part of the country (25).

Smith notes the effects a lack of water transport has on development:

> All the inland parts of Africa, and that part of Asia which lies any considerable way north of the Euxine [Black] and Caspian seas, the ancient Sycthia, the modern Tartary and Siberia, seem in all ages of the world to have been in the same barbarous and uncivilized state in which we find them at present. The sea of Tartary is the frozen ocean which admits of no navigation, and though some of the greatest rivers in the world run through that country, they are at too great a distance from one another to carry commerce and communication through the greater part of it. There are in Africa none of those great inlets, such as the Baltic and Adriatic seas in Europe, the Mediterranean and Euxine seas in both Europe and Asia, and the gulphs of Arabia, Persia, India, Bengal, and Siam, in Asia, to carry maritime commerce into the interior parts of that great continent (25).

Another early observation of the link between the sea and political development is by the nineteenth century explorer David Livingstone: 'The sea after all is the great civilizer of nations. If Africa, instead of simple littoral outline, had been broken up by deep indentations of glorious old ocean, how different would have been the fate of its inhabitants' (in Sowell 1983, 233). With as influential a thinker as Adam Smith emphasizing this point so early there was strangely little weight given to the importance of water transport in the twentieth century. Perhaps MacKinder (1904) was one of the last to explicitly base a political theory on transport costs; he also emphasized the land-water divide (also notable of course is Wittfogel 1957 and the 'hydraulic hypothesis'). Other partial or brief arguments similar to Fox can be found, but few that encompass the entire argument.

More Recent Examples

The historian Frederic C. Lane (1950) looks broadly at the relation between government and waterborne commerce in 'Force and Enterprise in the Creation of Oceanic Commerce'. Lane (1958) notes that the 'violence-using, violence controlling industry' was monopolized by governments 'at least on land' suggesting that in maritime societies this was not necessarily the case (402). William McNeill (1974, 44-53) is brief but explicit in emphasizing the strong influence of sea and river on trade and early political formation in Europe, and the difference in land and water transport efficiency. More recently, in 'Information and Transportation Nets in World History', McNeill (2000) further asserts the importance of the complex relations of transport costs in different geographic settings and their effect on trade, cities and development in an argument very similar to Fox. E.L. Jones (1974) touches on the importance of a long-term view of development, which is necessary to observe the cumulative effects of transport costs and differentiated transport costs on development, in considering the unique development of northwestern Europe and Japan: 'Some of the reasons lie far back in history, even prehistory…others lie in the agricultural progress of the seventeenth and eighteenth centuries. Better farming techniques were then adopted in the…favoured context of countries with cheap waterborne transportation…' (128-129). Derek Urwin (Rokkan and Urwin 1982) points out the importance of geography and particularly cheap water transport on political development in the United Kingdom (21-22). Gellner (1988) asserts the importance of the 'mercantile sea' as a voice of freedom against autocracy (162) and the difference between aggressive agricultural societies and commercial cities, an idea similar to Fox's 'two societies', stating that commercial towns or cities 'appear to constitute the one and only exit point from agrarian social organization' (151). Charles Tilly (1989) explicitly extends Fox's argument, considering further historical observations and implications. Roger Price's (1996) discussion of the effect of rail on the development of markets in France serves as almost an exact description of Fox's "land" economy with similar conclusions about the effects of transport costs on market development in a land-based state (86-108). These well known scholars all share Fox's view that incorporating geography, and in all these cases, transport costs, into an understanding of history is not simple environmental determinism, but

important to understanding long-term patterns of political, economic, and social development.

The Path Dependency of Development

> Some outstanding young economists and economic historians are also breaking ranks and finding important features descending imperturbably from (at least) the High Middle Ages, thus rediscovering the path dependence which historians have always asserted.
>
> E. L. Jones (1995, 79)
> *Economic Adaptability in the Long Term*

In economic growth 'the details of the geography that emerges—which regions end up with the population—depend sensitively on initial conditions. If one region has slightly more population than another when, say, transportation costs fall below some critical level, that region ends up gaining population at the other's expense; had the distribution of population at that critical moment been only slightly different, the roles of the regions might have been reversed' (Krugman 1991, 487).

Ideas of path dependent development, increasing returns and positive feedback have received increasing attention in the social sciences in the last decade. These ideas were earlier suggested to be related to the way commercial cities grow. Path dependency also reinforces ideas of social capital, as early influences on socioeconomic behavior might be magnified, not reduced, through time. Pierson (2000) emphasizes the importance of the concept to political and social development:

> It is increasingly common for social scientists to describe political processes as 'path dependent…" This article conceptualizes path dependence as a social process grounded in a dynamic of "increasing returns."…Reviewing recent literature in economics and suggesting extensions to the world of politics, the article demonstrates that increasing returns processes are likely to be prevalent, and that good analytical foundations exist for exploring their causes and consequences (251).

These ideas are especially important to long term processes. Early leads in urbanization caused by differing transport costs can have very large later consequences on social and institutional development. Pierson continues:

> The investigation of increasing returns can provide a more rigorous framework for developing some of the key claims of recent scholarship in historical institutionalism: Specific patterns of timing and sequence matter; a wide range of social outcomes may be possible; large consequences may result from relatively small or contingent events; particular courses of action, once introduced, can be almost impossible to reverse (251).

Pierson argues that these effects 'stand in sharp contrast to prominent modes of argument and explanation in political science' and are so strong that 'they will shake many subfields of political inquiry' (2000, 252). These ideas are of course not new, as such well-known arguments as Gerschenkron's (1962) study of industrialization and state building and Lipset and Rokkan's (1967) analysis of the formation of party systems makes clear (Pierson 2000, 264). However, these studies are classics in part precisely because they were ahead of their time in asserting the path dependent nature of their subjects. This approach is only now becoming widespread, as the dynamics and magnitude of increasing returns and positive feedback effects become better understood, especially in economics. Following Pierson, it seems likely that the effects of early leads in commercial city development had very large and long lasting effects, allowing for economic growth as well as the development of the skills and institutions needed to grow still further, and the political systems able to coexist with and even foster commercial activity. This created a virtuous cycle that simply had little chance of starting in inland agrarian societies (discussed further below).

Agglomeration and Space

That all economic and social activity happens in space means that transport costs affect all human activity. Simply adding space into the imaginary uniform world that economists often study is sufficient for complex patterns to develop. This insight has long been central to theories of economic geography and rediscovered (and formalized with more complex mathematical models) in the 'new' economic theories of the last several decades (Krugman 1995, 1998; Fujita and Krugman 1999). Space alone, even with no other geographical or environmental variables, is sufficient to cause agglomeration of people and industries, and even specialization, as once

agglomerations form, it makes economic sense for each to specialize in producing different things, taking advantage of knowledge spillovers and economies of scale.

Krugman and Venables' Model

A simple model which adds space into neoclassical growth models predicts the formation of a steep divide between urban/industrial and rural/agricultural areas. This supplies theoretical support to Fox's argument, where the existence of these two societies was assumed without theorizing on economic causes besides transport cost differentials. The simplicity of this model lends itself to modification to incorporate Fox's focus on the different transport costs of land and water, considered below. The initial input into the model is falling transport costs through time, pictured in Figure B-1 below. (This simple idea is shown because it will be modified in Figure B-5.[142])

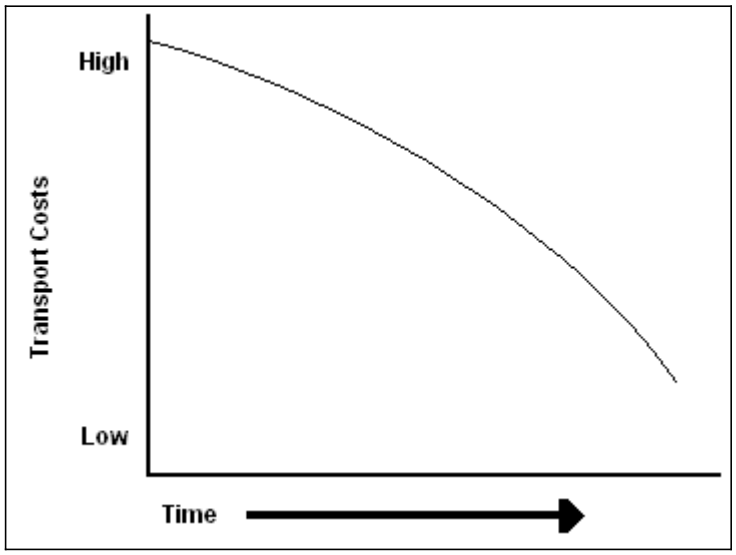


Figure B-1 Falling Transport Costs

This simple idea of falling transport costs is combined in Krugman and Venables' model with agglomeration effects on industry and trade. There is much debate on the causes of agglomeration effects, such as whether they result more from positive externalities (i.e. spillovers), market size effects, and/or other factors.[143] But the existence of cities since ancient times, and industrial districts and conurbations in

[142] Figures B-1, B-2, B-4 and B-5 were made by this author to represent ideas from Krugman and Venables (1995) and Fox (1971, 1989, 1991), but are not by Krugman and Venables or Fox.

[143] Martin and Sunley (1996) discuss in detail the relation between what has been called 'geographic economics', much of which stems from the work of Krugman, and economic geography.

modern times attests to the long and continued existence of agglomerating forces. The combination of agglomeration effects with falling transport costs gives a theoretical evolution of agglomeration that can be pictured like this:

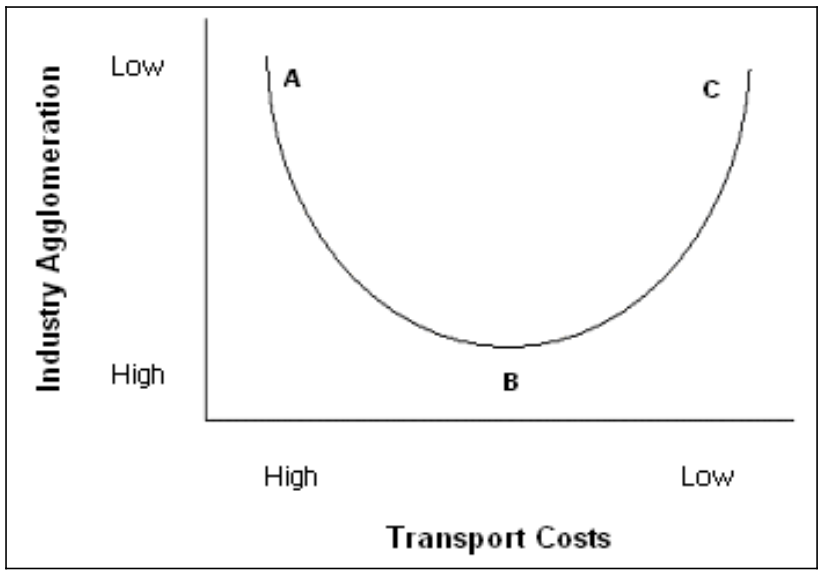


Figure B-2 Transport Costs and Agglomeration

Industry and trade began to grow long ago in times with very high transport (and communication[144]) costs (poor roads, no railroads, etc.); every region was self sufficient in most goods or did without, and there was little agglomeration as every region had to supply itself (A). As transport costs began to fall with better roads, waterborne transport, and eventually railroads, then trade and commerce likewise increased. Lower transport costs enabled manufacturers to begin to cluster together to benefit from agglomeration effects (such as knowledge spillovers, forward and backward linkages, concentrated labor pools, concentrated and large markets) using new transportation methods to ship their products to customers, eventually around the world (B). Eventually, though, as transportation and communication costs continue to fall manufacturers will move away from agglomerations and industry clusters to take

[144] Communications costs and speed will not be discussed to keep analysis simple and because before electric communications, communication costs and speeds were closely related to transport costs and speeds. For an analysis of communication networks similar to this chapter see McNeill (2000). On a related note, the rise of electric communication, especially the internet, has brought many claims of 'the end of the city'. Besides suburban sprawl, a phenomenon most noticeable in the US, there is much evidence that the opposite is happening. Cities continue to grow and less urbanized countries that have electric communications continue to urbanize. Furthermore, industries often continue to concentrate, and industrial and trade activity is extremely concentrated geographically in cities and districts (Garreau 1991, Easterly and Levine 2001); in areas with cheap water transport, even in the last 100 years of increasingly cheap land and air transport, there has still been increasing, not decreasing concentration of growth (Sachs 1997).

advantage of cheaper space and labor. Transport costs become so low that agglomeration is not necessary (C).

Land versus Water: The Costs

Before continuing, we should note the degree to which land and water transport costs diverge, and the possible objection that as technology progressed with railroads the importance of this divergence has dropped. The latter objection is considered below, but it should be noted that in part even if it were true, it would be somewhat irrelevant in a cumulative causation argument, where early leads lead to institutional changes that create a self-reinforcing cycle of development without the need for continued influence from the early factors (such as transportation).

Von Thünen, often considered the founder of the study of space in economics, tested the limitations of trade in an inland agricultural state in forming his theories in *The Isolated State* (1826). He had a wagonload of grain with two drivers and four horses drive along a straight, flat road, to see how far they could go if they fed themselves and the horses from their load and saved half of the grain for the return trip (an idea later incorporated into mainstream economics by Paul Samuelson as "iceberg" transport costs). The distance was only fifty miles, and under everyday conditions was even less, with a working radius of only twenty to thirty miles (von Thünen in Fox 1989, 333). Bairoch (1993) gives an example of preindustrial transport costs, also in terms of cereals, one of the more important items of commerce for the development of cities. Bairoch says that before the age of steam power and railways, the average cost of transporting a ton of cereals a kilometer by cart was 3.9 kg of the cereals as opposed to 0.9 kg for transport by river or canal, and still much cheaper by sea at 0.3-0.4 kg. Shipping wood, important for heating in Europe, as well as smelting metals and other uses, is still more difficult. Transporting pinewood over a distance of only 2 kilometers by cart doubled its price. By inland waterway the distance is instead 10-16 kilometers, and in favorable conditions (shipping wood downstream), this might be extended up to 100 kilometers before doubling the price by water (Bairoch 1993, 60). The limitations of land transport were very large before rail, and the advantages of downstream and ocean transport were many times that of land transport.

Areas with both coast and rivers are especially important due to the synergy of riverine and oceanic transport and the role of rivers in 'draining' an area of goods. This role of rivers is often recognized, but the importance of there being both coast and rivers is not always clearly asserted. Coastal cities are important for commerce, but rivers play a special role in supplying cities, often more than the sea. If goods can profitably be brought to markets from 100 kilometers, for example, that means a coastal area has access inland to 100 kilometers of agricultural goods, where a river has access to 200 kilometers (100 kilometers in each direction) of often very rich agricultural land, that furthermore can often be irrigated, along its entire navigable length deep into the interior. As noted earlier, shipping downstream (especially of food, building materials, and heating and smelting fuels) offers very large advantages in transport costs, making very large cities at the mouths of rivers especially viable. Rivers potentially give access to immense amounts of agricultural and other inland goods, such as wood and stone for building. Where these rivers coincide with coast, this effect is magnified by the synergy with long distance ocean-going commerce.

Transport Costs in Modern Economies

In the modern economy, a standard assumption of trade theory is that transport costs have fallen enough that they are not important in patterns of trade, and that modestly higher transport costs because of distance or geography are more than offset by lower wages (Sachs 1997, 6). However, Sachs points out that in many developing countries industry is heavily dependent on imported intermediate inputs (in apparel and electronics industries and other assembly operations). In a typical electronics exporting zone, each 1 dollar of final exports contains as much as 85 cents of imported inputs. In such cases a mere 10 percent increase in the final price caused by higher transport costs represent as much as *two thirds* of the value added price, imposing a potentially insurmountable obstacle to export competitiveness (Sachs 1997, 6).

The effects of low transport costs associated with coastal proximity in modern less-developed as well as modern highly-developed nations, along with the insurmountable costs Bairoch describes in the past, suggest that the effects of transport costs both before and after the industrial revolution are salient, and careful comparisons from different time periods can be valid.

Railroads

Railroads clearly had strong effects on European state formation and economic activity. However, there are three reasons railroads did not fundamentally change the oceanic/territorial divide between European nations: (1) Although rail radically lowered land transport costs, steam power, ship canals, and other technical developments continued to lower water transport costs as well. This alone, though, is likely not a sufficient explanation, for the relative change in land transport costs was likely greater than the relative changes in water transport costs;[145] (2) more importantly, rail simply did not become widespread until after 1850, when many of the patterns and even more of the sociopolitical characteristics of European polities were already well developed. Figure B-3 shows how little rail was developed by 1850, and how much of this was serving not the territorial powers but instead increasing the effectiveness of British commerce:

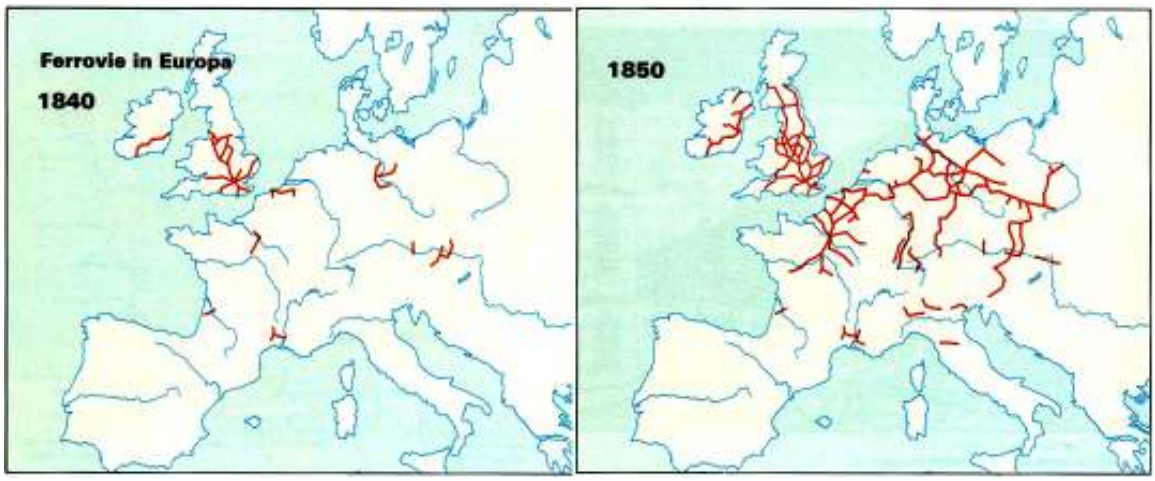


Figure B-3 European Railways in 1840 and 1850
Source: Vidal-Naquet and Bertin (2000, 195)

(3) building rail systems in Europe was so large an undertaking it was mostly carried out by governments, and many of the rail systems were built to supply central

[145] The introduction of containerization in the 1960s radically reduced shipping costs once again, maintaining the difference in water and land transport and deeply affecting development in many ways; the dramatic effects of changing technologies in shipping on London are described in Hall (1998, 889-892). Long before this, key ship canals, especially the Suez (1869) and Panama (1914, with the slogan 'The Land Divided, The World United', *World Book* 1997), also drastically reduced shipping costs and times, with far reaching consequences. Fox (1991, 138), for example, places strong emphasis on the impact of the Suez Canal on Britain and India.

capitals, increasing their growth and power to centralize and consolidate territory. Note in Figure B-3 the focus of rail in Prussia on Berlin and in France on Paris, neither of which are oceanic ports.[146] In the UK, while rail also supplied the capital, London was of course also an oceanic port, and rail served many other ports, with the first operable line in Europe connecting Manchester with its port of Liverpool, not supplying London. Perhaps more importantly than these three reasons, Sachs (1997) empirically shows that coastal productivity has risen relative to inland productivity in the United States over the last 100 years, even with greatly decreased rail, trucking, and communications costs and the addition of air transport. This suggests that the effects Fox focuses on are important even today and likely were throughout the period of industrialization in Europe as well.

Limited Disagglomeration in the Real World

We have so far discussed a basic theory of how space alone can lead to agglomeration, with a theory of a U shaped relation between falling transport costs and agglomeration, with agglomeration at first increasing and then decreasing as transport costs continue to fall. As we will discuss in further detail, it is well documented that this does not in fact happen in many cases. Although transport costs have continued to fall, and some industries do leave agglomerations to take advantage of cheaper costs, historical studies and recent empirical evidence suggest that Krugman and Venables' model in Figure B-2 is correct until (B), but that a move to high disagglomeration (C) tends not to happen, as casual observance of many industries (e.g. Silicon Valley) as well as the phenomenon of conurbations (e.g. the northeast United States, southeast England) highlights. However, the model is a useful way of thinking about how real world agglomeration has been in part caused by falling transports costs. The world of large and growing cities that influenced state and social development is in part caused by the simple fact that transport costs have fallen for millennia.

[146] Ades and Glaeser (1994) show how autocratic governments tend to have single giant primate cities due to political as opposed to economic causes.

Adjusting Krugman and Venables' model to fit Bairoch's empirical evidence gives something that looks like Figure B-4, with (A), (B), and (C) here having the same meanings as in Figure B-2:

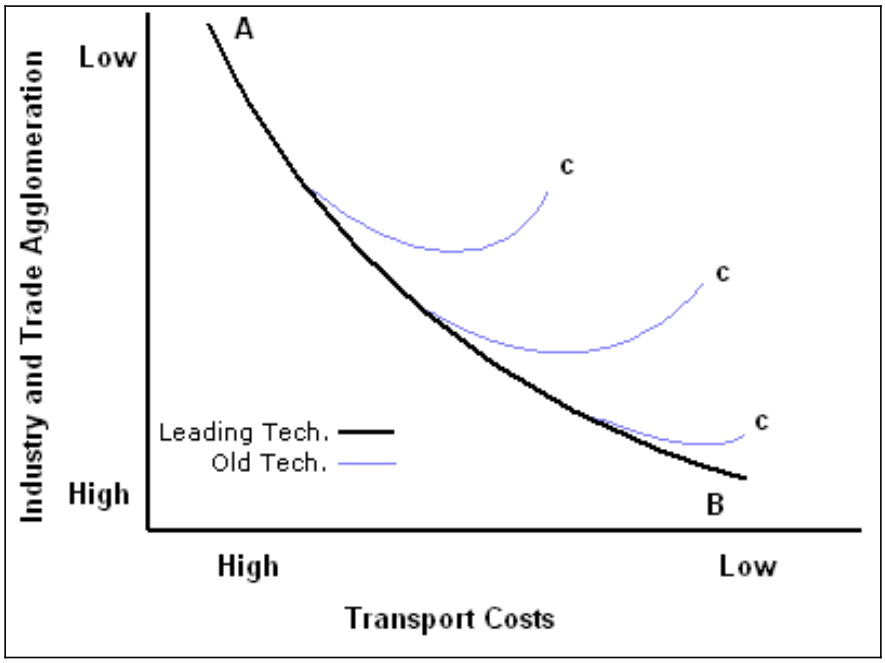


Figure B-4 Modified Version of Krugman and Venables 1995

Where (A) is an initial state of relative self sufficiency in the absence of commerce due to high transport costs and (B) is the high level of agglomeration of industry and trade seen at both national and global levels through history *and* today. The gray lines (c) represent the smaller amount of often older industries that do follow Krugman and Venables' model, separating from agglomerations to take advantage of low factor costs, usually wages and land. Also, medium and low-tech industries sometimes do find the appeal of cheap land and labor sufficient cause to move to (c).[147] But these, compared to total industry and trade, are relatively insignificant. The real world is largely characterized by agglomeration of wealth at both the national and international levels; economic development and city formation is highly uneven (Easterly and Levine 2001), suggested by (B) on the graph. Modifying Krugman and Venables model to take into account 'first to the table' and agglomeration effects suggests

[147] Some industries and firms become so large that they are essentially self sufficient, and move away from agglomerations (or more recently are induced to move by governments often becoming 'weakly embedded multinationals' or the 'cathedrals in the desert' of southern Italy). Being self sufficient they rarely help local economies develop as much as expected.

instead a division of economic activity into a vital, industrial core and a poor raw materials supplying hinterland. But where will this core be, and what might cause it to be there?

In Krugman and Venables' model the fact that throughout history there has been a secular downward trend in transport costs is focused on. But the correlation of economic activity and low water transport costs suggests that another factor could easily be added to their model. This would be the extreme difference between waterborne transport costs against land transport costs.

Land and Water: Krugman/Venables and Fox Combined

One shortcoming of Figure B-2 and Figure B-4 is that they do not take into account the very large difference in water and land transport costs throughout history, reflected in the facts above. The transport cost input for a model that takes these into account, instead of the simple downward slope in Figure B-1, can be illustrated like this:

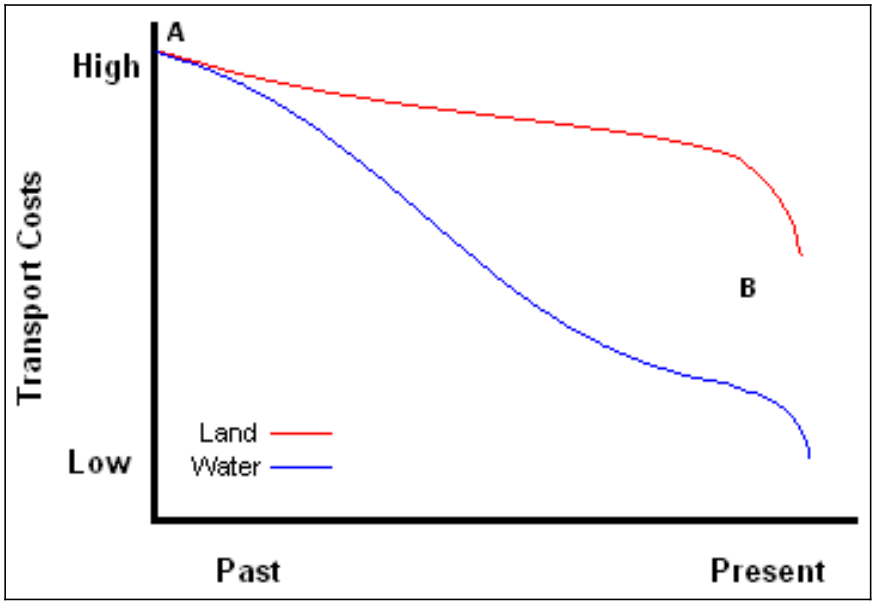


Figure B-5 Modified Transport Cost Input (From Figure B-1)

This stylized depiction of transport costs over time shows both the large difference in water and land transport costs (e.g. Smith 1776, Fox 1971 etc.), and that they steadily fall over time (e.g. Krugman and Venables 1995). (A) represents mankind at the dawn of the first watercraft. Transport costs fall with new inventions in both land

and water transport (imagine [B] as roughly the age of steam and railroads[148]). But with this model of transport costs commerce and agglomeration occur to a high degree on coasts and large rivers, and a much lesser degree inland. At (B) coastal societies still experience, and have experienced for millennia, far lower transport costs than inland areas ever experienced. The direct and indirect (positive feedback effects) of this on agglomeration would be accurately predicted by this model to be large with most development near ocean navigable water.

Water Transport and Industrial Location

As discussed in the previous section, the differences in land and water transport costs predict a sharp divide between areas with more and less industrial agglomeration. Figure B-6 below illustrates the large number of ocean navigable rivers in Europe, with an especially large concentration (the tributaries of which are not visible) centered on the Rhine region of central Western Europe with synergistic outlets near the extensive coastlines of the North, Ligurian and Adriatic Seas.

[148] Why rail did not change the patterns of state development as much as might be expected was considered above. Another interesting recent factor is air transport. Often the largest airports are near older port cities, demonstrating the path dependence of development again (e.g. Amsterdam, London, Barcelona, New York, Houston, Memphis [the hub for the extensive air operations of Federal Express]). The importance of transport to growth is reflected in one airport's creation. In the early 1970s the city government of Dallas sent a delegation to Europe to look at large European cities for inspiration on how to grow. The head of the delegation, while in Athens, looked out on the port, and having read the words of Thucydides on the role of Athens' harbor, decided Dallas had to become a port to prosper. On the delegation's suggestion Dallas and Fort Worth, lacking a large river, joined to build what at the time was the largest airport in the world and is now the third busiest in the world. Dallas and Fort Worth have seen immense growth since then, especially near the airport (*D Magazine* 1999). The recent growth of the inland cities of Dallas, Atlanta, and Denver is closely related to their role as (air)port cities, (and rail junctions in the past); as the 'hub and spoke' system became more centralized since the 1970s these became the hubs for some of the largest airlines in the world (respectively, American, Delta, and United airlines).

Figure B-6 Major European Rivers

Figure B-7 (next page) illustrates the patterns of commerce and trade in thirteenth century Europe. These are concentrated in the areas with the highest confluence of large navigable rivers and the ports deepest in the interior of Europe. The poles reach out to each other through trade, forming mostly ephemeral fairs inland but long lasting commercial cities on navigable rivers.

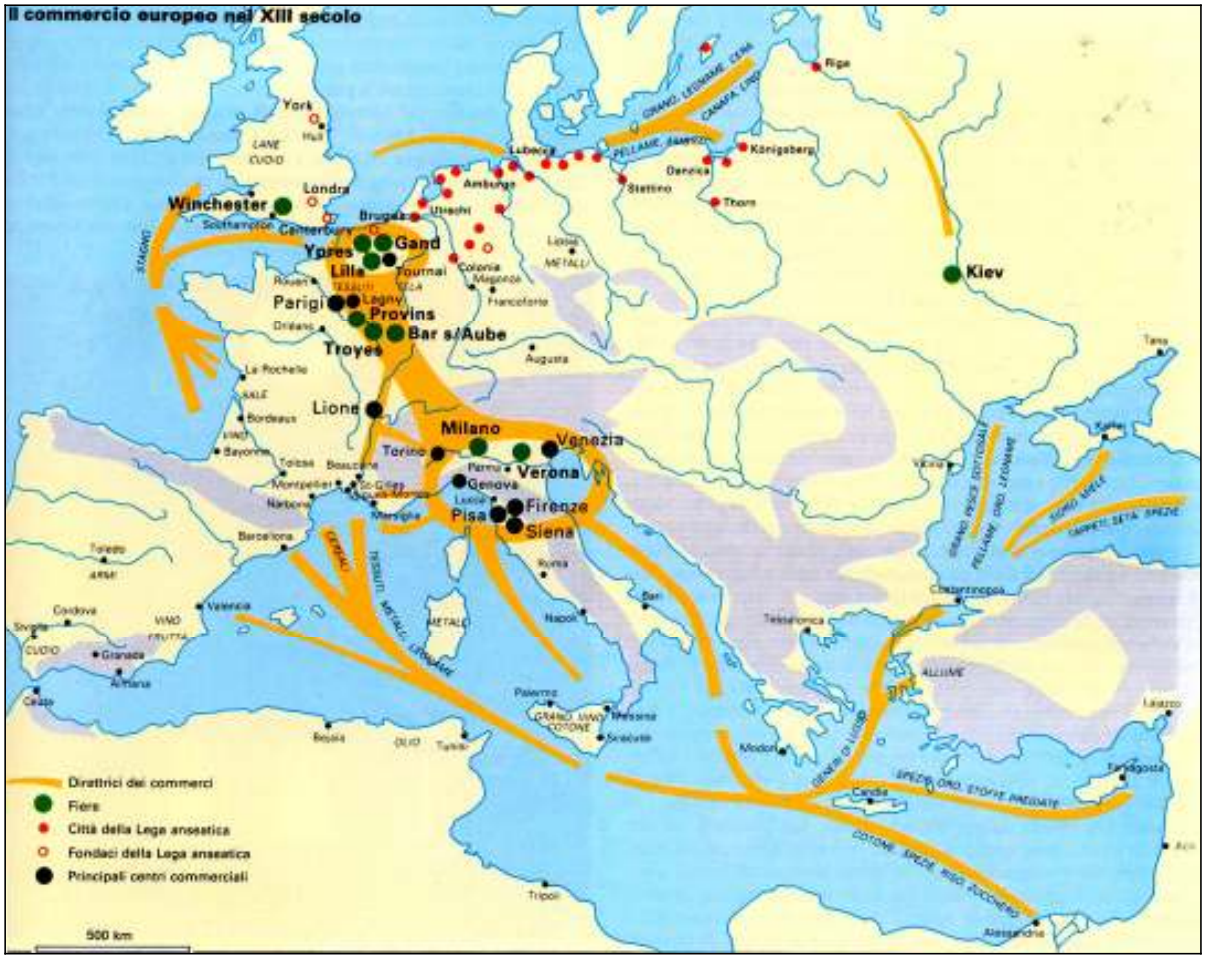


Figure B-7 Thirteenth Century Commerce in Europe
Source: Vidal-Naquet and Bertin (2000, 119)

These patterns of early urbanization and trade were long lasting, with uninterrupted regional histories of increasing industrialization. Figure B-8 below shows that most of the areas of early commerce and urbanization became those areas with early industrialization.

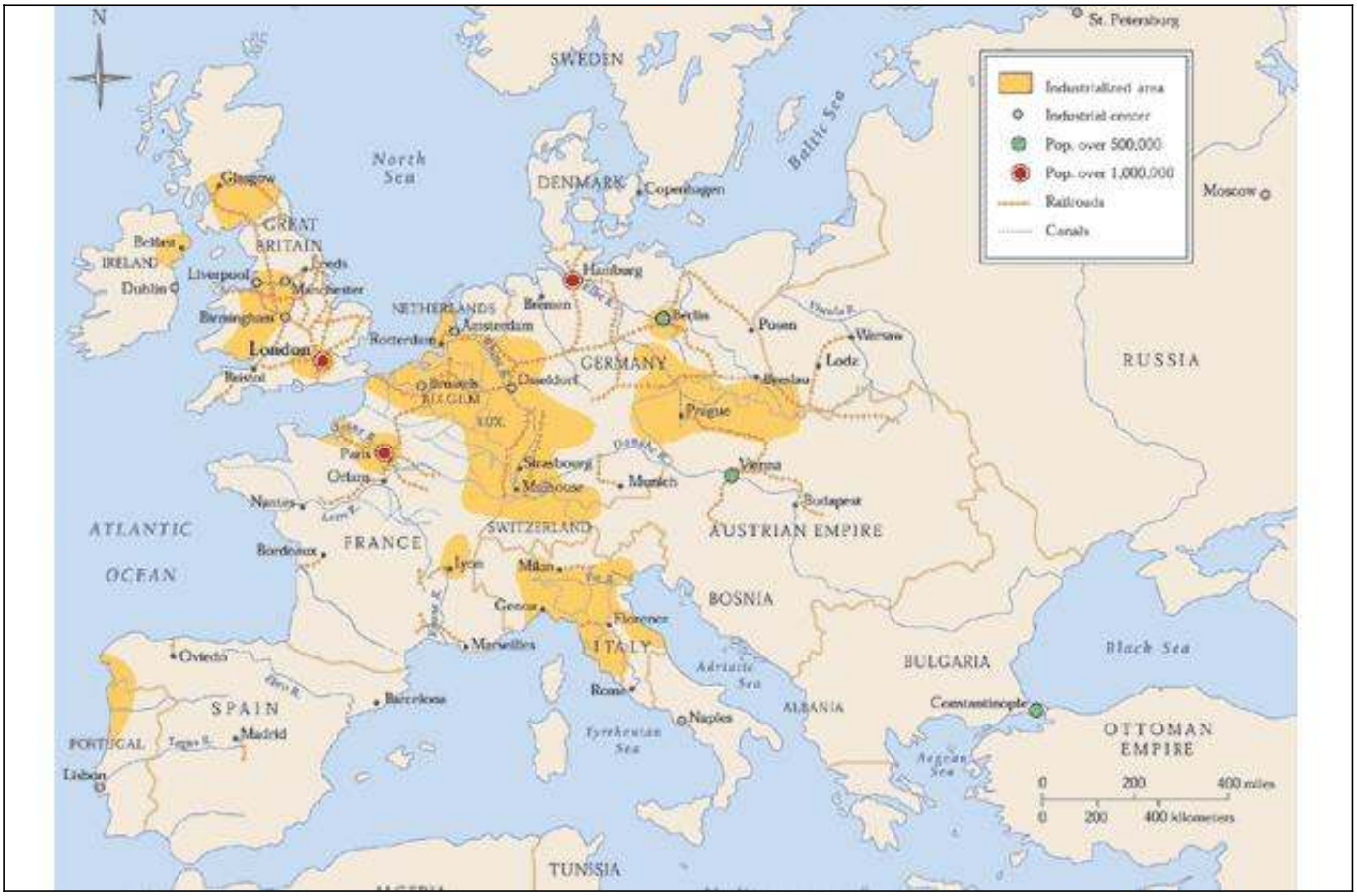


Figure B-8 Industrialized Areas of Europe, 1850

Figure B-9 below is a map of European capital cities and cities with over 500,000 people in 1989, with the accessibility of the cities to the total population of Europe for a one day visit. This measure serves as a good proxy for the most important centers in Europe for business, research, culture, and where capital investments and media are concentrated (Jönsson, Tägil, and Törnqvist 2000, 159-160). It clearly suggests what is sometimes called the 'Blue Banana', 'Baroque Arch' or 'Lotharingian Axis'. The pattern in Figure B-9 shows an uncanny similarity to the commercial and trade patterns of thirteenth century Europe (Figure B-7 above). The post thirteenth century growth of the UK is perhaps the most noticeable difference, but again follows the pattern of growth from commerce by sea. Figure B-9 would even look more similar except that the cutoff for cities is 500,000, which means the dense medium-size commercial cities in northern Italy today, and many of the former Hansa area, do not show up (the northern Italian cities of the fourteenth and sixteenth centuries can be seen in Figure B-17 and Figure B-19 in this essay). In 800 years the commercial pattern of Europe shows very little change.

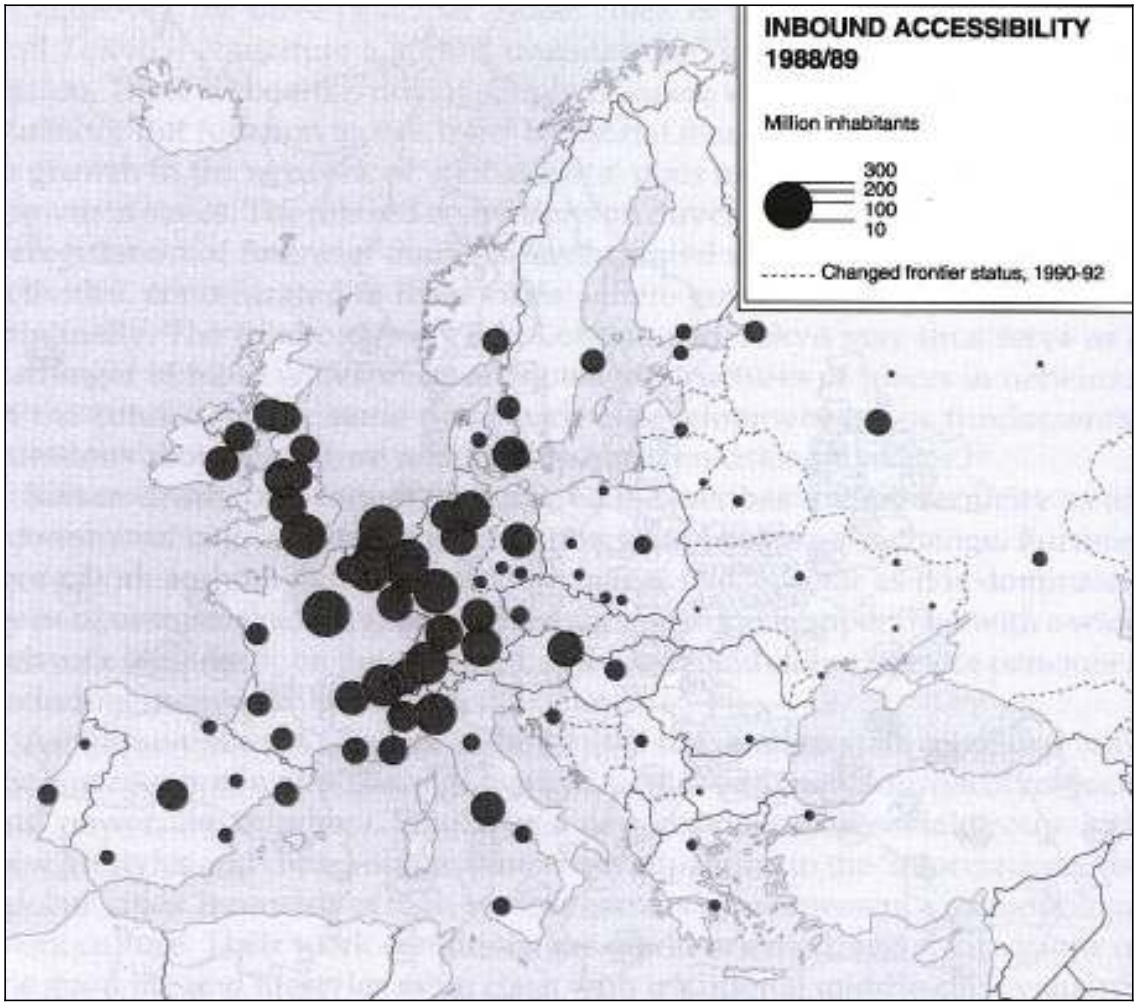


Figure B-9 Inbound Accessibility in Europe, 1988/1989
Source: *Sweden in the World: National Atlas of Sweden* (1993) in Jönsson, Tägil, and Törnqvist (2000, 160)

Figure B-10 and Figure B-11 illustrate this same path dependency in the population density of Europe and the distribution of economic activity in Europe.

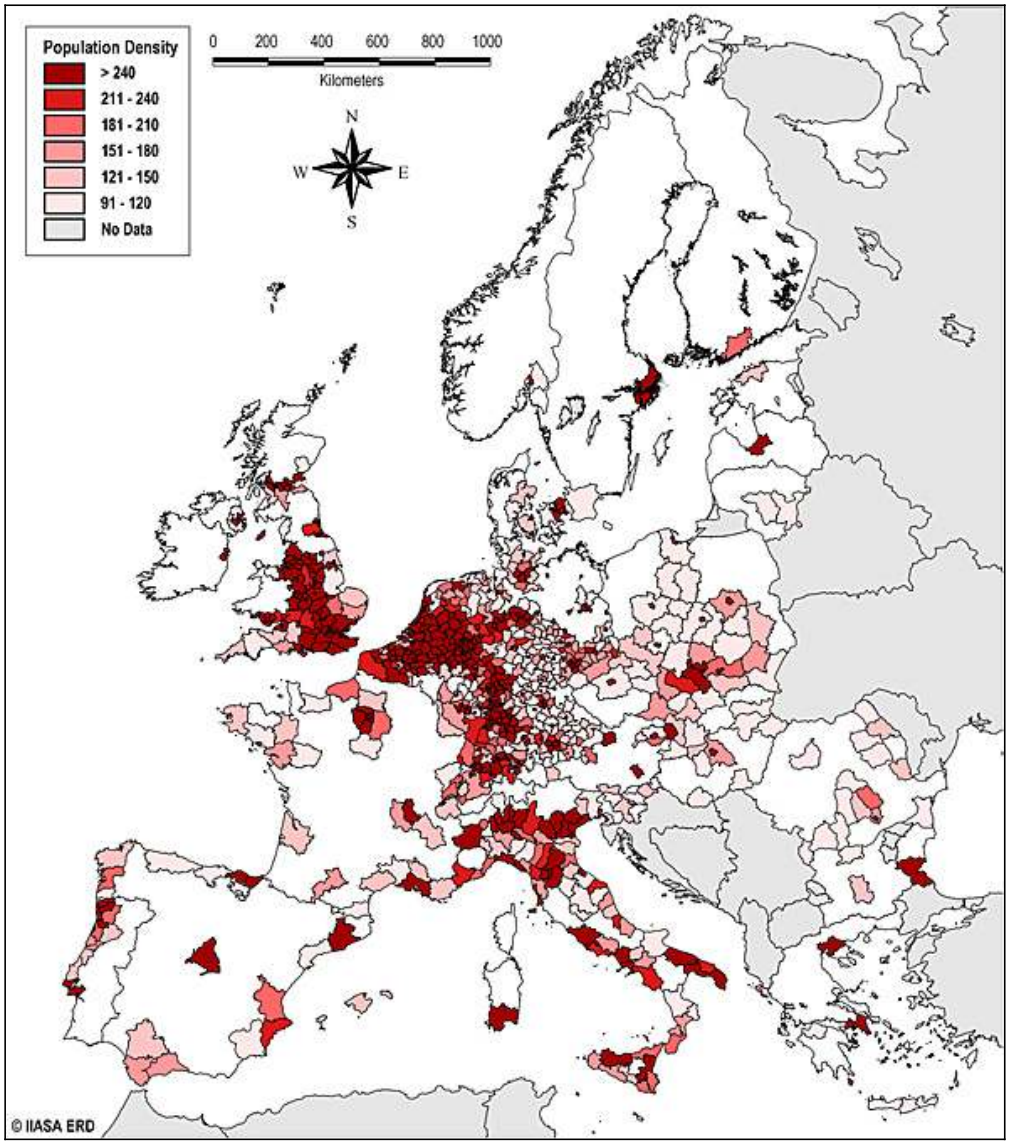


Figure B-10 Europe: Population Density by NUTS3 Areas
(greater than 90 inhabitants per square kilometer)

Source: The International Institute for Applied Systems Analysis (IIASA)

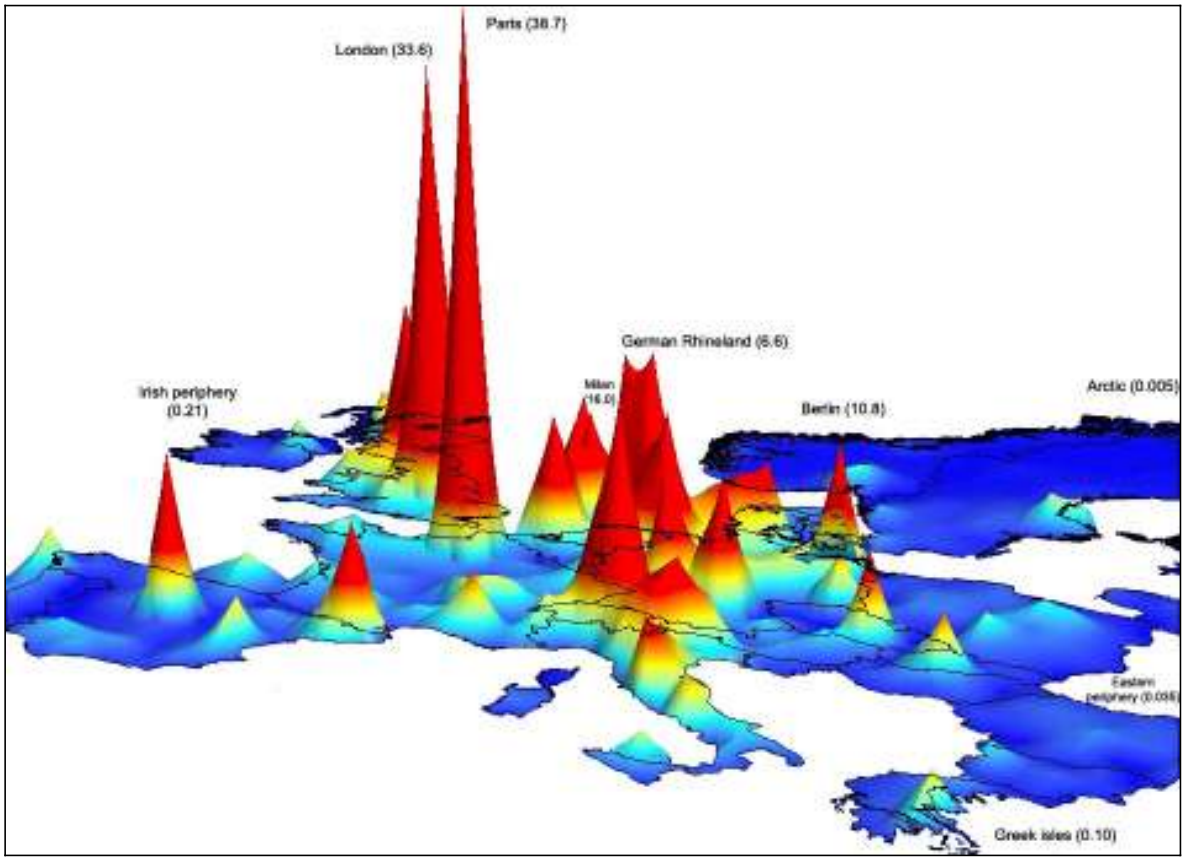


Figure B-11 European economic activity by square kilometer
Source: G-Econ Project, Yale University

North America: A Natural Experiment

One way to test the extent to which transport costs related to rivers and coast were responsible for the location of an economic core stretching from northern Italy to northwest Europe would be to wipe away all the development and all the cities in Europe, and then run the experiment again with different historical variables but the same geographic variables and see if the same pattern reoccurs. This is essentially what happened in North America which, after Europe, has the highest coincidence of temperate coast with navigable river/productive agricultural land in the world (this is visible in Figure B-12 below; East Asia is second to Europe within Eurasia where the earliest development was by far the most likely; North America became a factor after the spread of Eurasian crops and animals around the globe). North America had no

commercial cities[149] when it began to be slowly populated and developed by Europeans for over five centuries. If the urban and economic patterns of Europe were random, or at least not dependent on the factors of water transport and rivers and agriculture, one would expect that chance would cause a substantially different pattern of urban development and commerce than in Europe, as development occurred thousands of miles and many hundreds of years later than the formation of urban patterns in Europe. If historical contingencies were the more important factor, there would be very different outcomes of development than in Europe.

This is not the case. The pattern of economic activity and location of cities in North America is virtually identical to that of Europe, with the lion's share of all economic activity and most commercial cities on the web of navigable rivers or coastline. Despite appearing to be largely continental, the United States is in fact a 'coastal' nation, and its economic activity and city system looks like the system of cities in 13th century northern Italy and the North and Baltic Sea/river system, as well as modern Europe, and with a similar distribution of wealth and commercial activity. The same factors that accurately predict the location of the Hanseatic league and Italian city-states predict the location of the urban core and wealth distribution in North America (Figure B-12):

[149] For the reasons Diamond (1999) illustrates. The Aztecs did have a few commercial cities (see, for example, Yoma and Martos Lopez 1996), but these disappeared or became mostly European soon after contact with Europeans (Meyer, Sherman, and Deeds 1999) primarily because of the Eurasian germs the Europeans carried (McNeill 1976, Diamond 1997). The natural experiment here considers only the area north of the Aztec and Mayan regions.

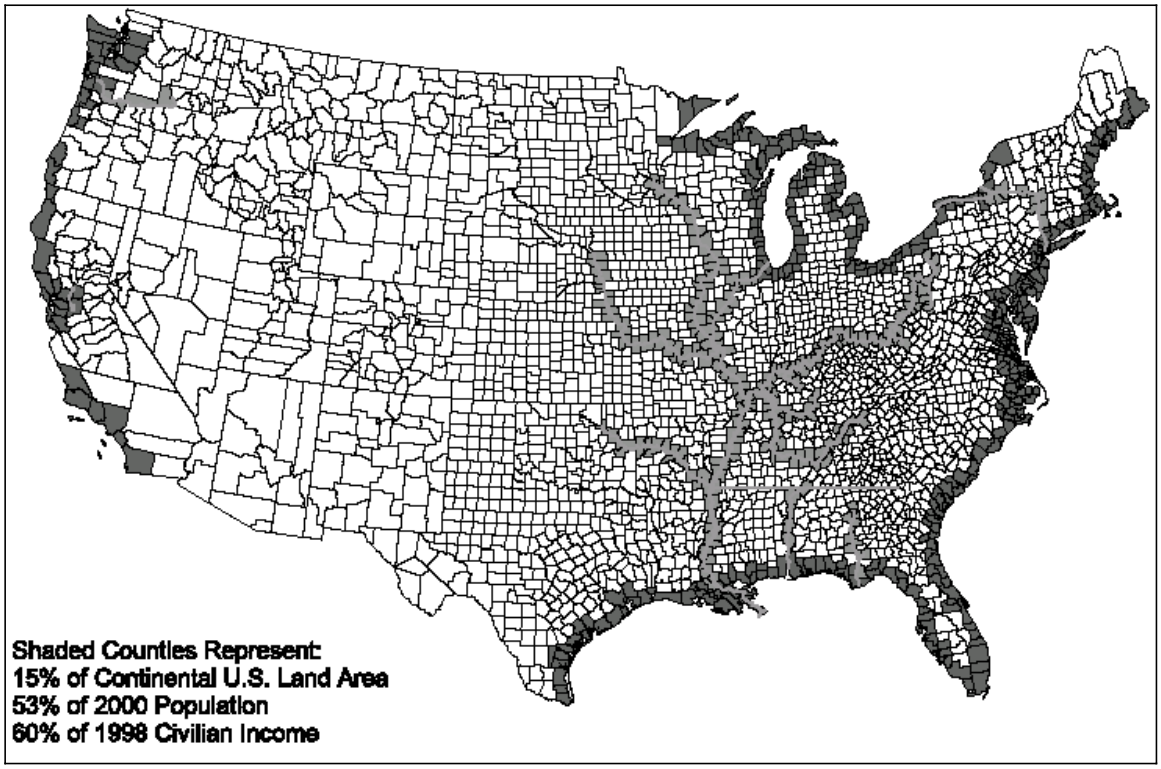


Figure B-12 US Counties within 100 Km. of Ocean Navigable Water
Source: Rappaport and Sachs (2001, 57)

Looking at counties in the United States, 53 percent of US population is within 100 kilometers of ocean navigable water, accounting for 60 percent of civilian income in the United States from only 15 percent of its land area. Measuring by areas instead of counties 100 kilometers from ocean navigable water shows an amazing *67 percent* of US population is coastal (Gallup, Sachs, and Mellinger 1999: 5), accounting for a still larger percentage of total income. In Figure B-12, important economic centers not usually thought of as coastal can be seen to be on the web of ocean navigable rivers, such as Tulsa, Oklahoma and Omaha, Nebraska.[150] This pattern is very visible in a map of the distribution of economic activity by square kilometer as well (

[150] The economic activity and size of these inland ports is greater than one might think. The metropolitan population of Omaha is almost 650,000, and it is one of the world's leading food processing centers. The metropolitan population of Tulsa is over 700,000. It leads the world in the manufacture of industrial heaters and winches, and is home to the headquarters of over 350 oil related companies (*World Book* 1997). There are simply few non-port, non national-capital cities in the world that have the level of economic activity of even these relatively modest inland port cities, which are not even state capitals.

Figure B-13). The economic activity of Canada is similarly concentrated on the Great Lakes and St. Lawrence Seaway, and Vancouver on the Pacific.

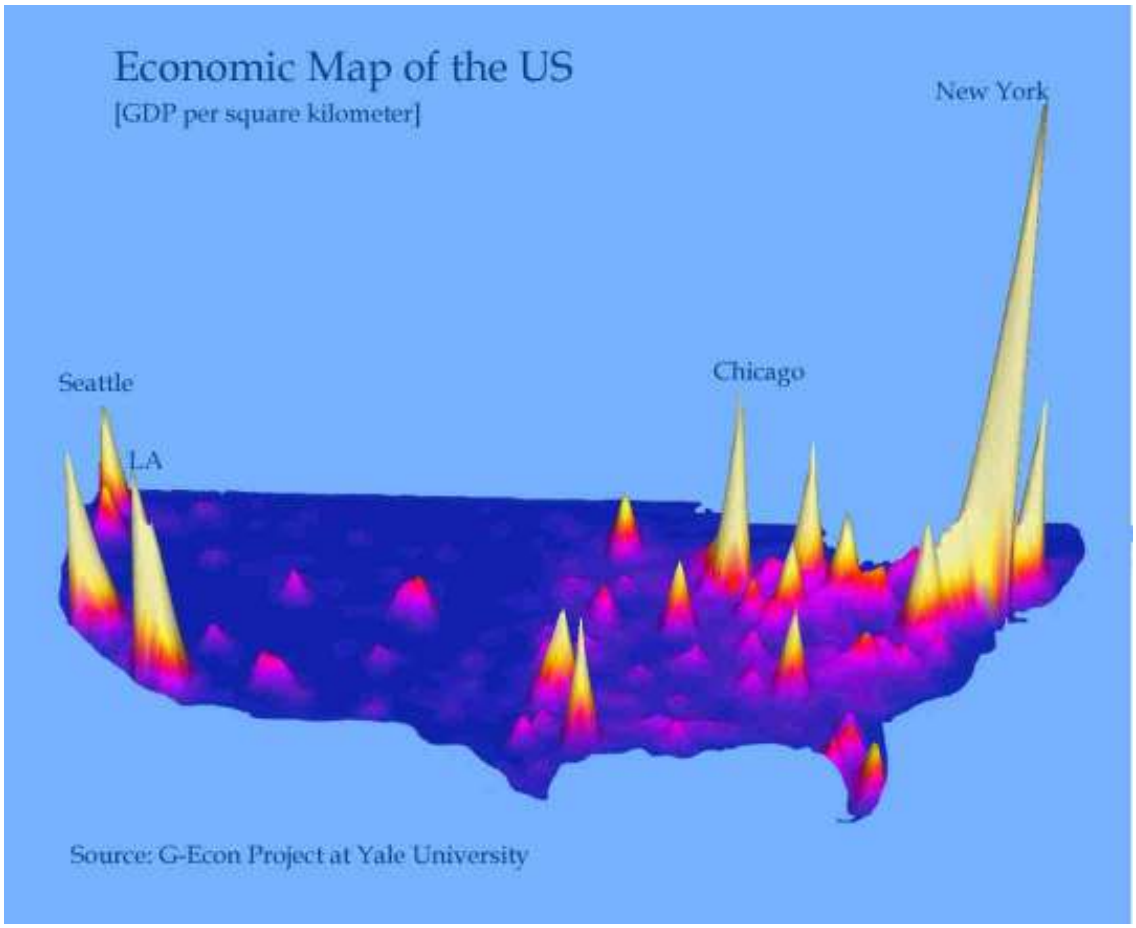


Figure B-13 GDP per Square Kilometer – United States
Source: G-Econ Project, Yale University

Starting from an essentially blank slate, the economic activity and pattern of commercial cities in the United States and Canada followed the same pattern of riverine and maritime development and wealth as in Europe. Historical contingencies seem less relevant to the rise of commercial states and societies than the simple factors of the position of rivers and coast in the location of cities and the distribution of wealth and commerce. Furthermore, these patterns hold in the Unites States for hundreds of years, and in the twentieth century have been increasing, not decreasing (Rappaport and Sachs 2001, 29), showing that improvements in land transportation and communications have not altered the impact of cheap oceanic commerce.

The comparison above shows how ‘re-running’ the European experiment gives similar results in an area with similar geography but substantially different historical details.

Transport Costs at the Global Scale

Note also that in China the distribution and intensity of economic activity follows the same transport-cost, path dependent pattern as in Europe and North America (Figure B-14 below).

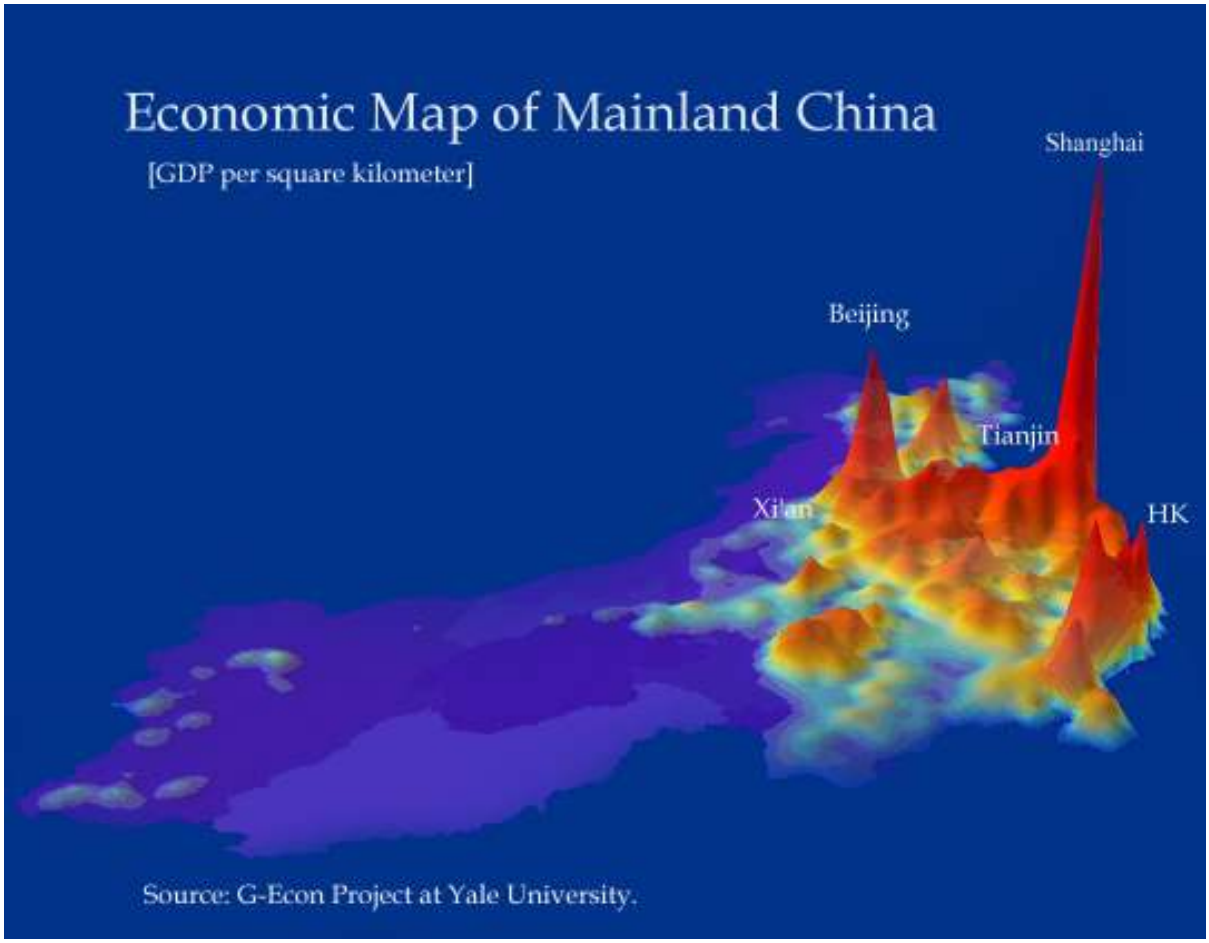


Figure B-14 GDP per Square Kilometer – China
Source: G-Econ Project, Yale University

Fox’s association of commercial areas with areas of low transport costs seems to hold true. However, his argument further asserts that these commercial areas influenced the political and institutional environment of regions and the states that would form in those regions. This seems to some obvious – there should be a self

reinforcing (cumulative causation) effect where commercial society develops which in turn is better suited in its institutions to further future commercial development and success in what we now know would become a world of globalization and international capitalism. However, we think there is more than the simple obvious development of commercial institutions in areas of high trade. There is an inherent dichotomy in social capital and the institutional form of economic organization that makes these more readily become spatially patterned by the inherent land-water dichotomy of transport costs. We will first discuss this inherent dichotomy of social capital and institutional form before further considering its relationship to patterns of uneven development.

The Two Worlds of Social Capital

Cultural explanations that attempt to explain the gap between the haves and have-nots are, like Fox's two societies, very often dichotomous. This is not always evident, as in two well known social capital theories, those of Putnam and Banfield,[151] where the dual division is implicit into (1) those with more and (2) those with less social capital, or by Banfield into (1) those in more of and (2) those in less of a state of amoral familism. Jane Jacobs, in *Systems of Survival: A Dialogue on the Moral Foundations of Commerce and Politics* (1992) attempts to understand why there seems to be a tendency for these types of theories to be dichotomous, and the significance of the two poles implied by these theories.

Jacobs collected moral and value judgments of 'esteemed behavior' for fifteen years from historical and anthropological sources, as well as from newspapers for modern and popular accounts of esteemed behavior, and attempted to classify them. She ignores such universals as cooperation, courage, competence, patience, and wisdom. This leaves a list that seems full of contradictions, such as 'innovation' yet 'respect for tradition', or 'exert prowess' yet 'shun force'. However, careful examination reveals these morals to be connected into clusters which further overlap to form larger groups. For example, 'honesty' and 'respect for contracts' forms a

[151] Banfield's work is often considered the basis for the modern development of social capital arguments. He studied a small town in southern Italy and concluded that paradoxically, their values of honor and family came at the expense of wider cooperation that could lead to local development. He called this 'amoral familism'.

small cluster. ‘Promotion of comfort and convenience’, ‘be open to novelty’, and ‘innovation’ form another. Both of these clusters are related to trade and merchants. Other clusters, such as ‘loyalty’, ‘tradition’, ‘respect for hierarchy and discipline’, and ‘deception for the sake of the task’ are all related to the military and government.

If these interconnections are followed Jacobs suggests they form two large, mutually exclusive groups (Jacobs 1994, 23-50). These two groups are remarkably similar to the attributes Putnam gives to high and low social capital societies, Banfield to societies suffering from amoral familism, Fox to his two societies, Gellner’s description of warlike hierarchical societies and his suggestion that commercial towns and cities provided the only exit point from these, Sowell’s societies with high and low cultural capital, and countless other descriptions of social capital as well as descriptions of the conditions for the formation of institutions in North and Thomas (1973) and by many others (Table B-2):

Guardian Syndrome	**Commercial Syndrome**
Exert Prowess	Come to voluntary agreements
Be obedient and disciplined	Be honest
Be exclusive	Collaborate easily with strangers
Be loyal	Compete
Respect hierarchy	Respect contracts
Take vengeance	Use initiative and enterprise
Adhere to tradition	Be open to inventiveness and novelty
Be ostentatious	Be efficient
Shun trading	Shun force
Show fortitude	Promote comfort and convenience
Deceive for the sake of the task	Dissent for the sake of the task
Treasure honor	Invest for productive purposes
Make rich use of leisure	Be industrious
Dispense largesse	Be thrifty
Be fatalistic	Be optimistic

Table B-2 Jacobs’ Two ‘Moral Syndromes’
Source: Adapted from Jacobs 1994, 23-50

Taking and Trading: The Reason for Two Systems

Why two systems and no more? Fox derives two basic cultures from the two trade regimes mandated by long-term limitations imposed by very different transport costs in water and land. Jacobs, at a still more fundamental level, notes that all creatures besides humans have only one way of surviving, and that is by taking. Animals must forage or hunt to survive. Human beings in the past also used the 'taking' method to survive, and some groups still do. This method of survival developed a moral syndrome or code based chiefly around territory and force—the 'guardian syndrome'. Agriculture also relies on territory, encouraging territoriality and conflict to attain more wealth. But at some point humans also developed a second way of survival—trading, which is unique to human beings. Trading demands a very different set of moral precepts to function, the 'commercial syndrome'. This syndrome is based on voluntary agreement instead of force, on innovation instead of tradition, and on collaboration instead of exclusivity (Jacobs 1994, 51-56). Both Jacobs and Fox explicitly, and many others implicitly, base their most fundamental divide on the exact same factor, trade. Although there are shades of gray, the economic and political organization and effectiveness of societies relates to the extent that the society developed as traders or takers. Table B-3 shows Jacobs' and Fox's ideas, based on trade, and other similar ideas that are also binary.

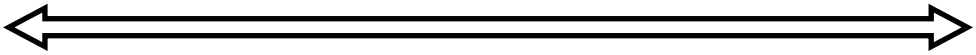
Worse	*Political / Economic Performance*	*Better*
		
(predominance of) Guardian Syndrome [152]		Commercial Syndrome (Jacobs)
Inland and Territorial/Hierarchical		Coastal and Commercial/Egalitarian (Fox)
Low Social/Cultural Capital		High Social/Cultural Capital (Putnam, Sowell, and many others)
Amoral Familism		Absence of Amoral Familism (Banfield)
Agricultural, Hierarchical, Territorial and Warlike		The Commercial 'Exit Point' (Gellner)
Institutions		
Those who have not 'gotten their act together'		Those who have 'gotten their act together' (Olson[153])
'Warlords and Landlords'		Finance and markets that stimulated new institutions (Tilly)
Poor/Few Institutions		Good/Many Institutions (North)

Table B-3 The Dichotomous Nature of Social Capital

[152] Jacobs' typology is more subtle than this table suggests. Jacobs attempts to show that both syndromes are good in the proper context; government plays many legitimate guardian roles, such as defense and police work, anti-trust laws, or sanitation enforcement. The problem comes when the two syndromes mix, as when police or government officials trade their power for wealth, or commercial people use force or deception and fail to innovate, or monopolies lose the commercial morals of thrift and innovation because of lack of competition, and use force to obtain their goals. However, when the guardian aspect of government is larger than it needs to be, the probability of 'syndrome mixing' increases, and a highly guardian society would be similar to other ideas such as amoral familism.

[153] This is not from Olson's classic *The Rise and Decline of Nations* (1982), rather it is from Olson (1996). Putnam views Olson's classic work on collective action, that more groups are bad rather than good, as opposing his (Putnam 1993, 176). However, Olson refers to rent-seeking groups that seek to control the distribution, not the creation of wealth. It seems there need be no contradiction between Putnam's and Olson's views as long as social capital is associated with groups concerned with the creation, not distribution, of wealth. Sowell (1983, 1996, 1998) strongly emphasizes the difference between those concerned with the distribution versus those concerned with the creation of wealth in his discussions of what he terms 'cultural capital', which is very similar to human capital plus social capital. Barzini (1964/1996) captures this idea well in a chapter on the *questione meridionale* (southern question), the North/South divide in Italy, when he says, 'There is a final reason, the fundamental reason. Southerners think mainly in political, not economic, terms' (250).

Agriculture and Social Capital

The fundamentally hierarchical, territorial, and military nature of societies more rooted in agriculture than commerce has been commented on countless times. Two clear expressions of this assertion are by the historical sociologist Johan Goudsblom (1996) and Ernest Gellner (1988, 1997). Goudsblom (1996) states that 'The crucial point, for which history provides us with abundant examples, is this: an agrarian community was virtually defenseless against organized military bands—unless it could organize an army of its own… The warriors needed the peasants for food, the peasants needed the warriors for protection. This unplanned—and in a profound sense, fatal—combination formed the context for the great variety of mixtures of military protection and economic exploitation that mark the history of the great majority of advanced agrarian societies' (58-59, note the use of the word 'fatal'; fatalism is the opposite of the commercial characteristic of optimism in Jacobs' syndromes). Gellner (1988, 154) asserts that 'Agrarian society is doomed to violence' because of its dependence on territory for wealth. Gellner (1997) points out many of the characteristics of Jacobs' guardian syndrome: agrarian societies 'despise work and value *honour'*, believed warfare and not trade was not only the quicker but the more honorable route to riches (18), are generally inegalitarian and have as their main function 'to reinforce, underwrite, and render visible and authoritative, the hierarchical status system' of the social order (20). Gellner points out that there has been one, and only one way that this fatal combination has been broken in history, what he calls the 'commercial exit point'. The only thing that needs to be added for this to be essentially the same as Fox's thesis is that the commercial exit point very often happened in states that had a high degree of commerce from water transport, with the exceptions being on unusually busy trade routes between commercial areas such as Switzerland, considered later.

In virtually all of the studies of social capital[154] and related concepts we find that these fall into two very similar dichotomies. Jacobs has perhaps been one of the most careful in showing why these tend to fall into two opposing groups. This natural dichotomy in social capital helps explain the easy fit between high and low transport

[154] Jonathan Haidt (2007) further develops a system of morals that complements and extends Jacobs work.

regimes and commercial and non-commercially oriented societies. There is a large and growing literature on how commercially oriented institutions diverged ever further from non-commercially oriented areas (and, to a lesser extent, on why agriculturally oriented areas have not developed, or, as Gellner and Fox argue, even act in self-destructive ways).

Thus there is a natural fit between high and low transport cost regions and inherent tendencies of institutional and social formation towards commercial (trading) and guardian (taking) syndromes. Once these patterns develop, they are reinforced over time as commercial areas develop ever more sophisticated commercial institutions.

The dichotomous nature of taking and trading societies makes these overlay the inherently dichotomous patterns of high and low water transport costs given an inherent real world pattern by land and water. These institutional patterns changed the overall balance of commerce and agriculture in whole regions, and in turn in the commercial, political and institutional orientation of the states that formed in those regions.

Fox's Two Societies and Positive Feedback on Growth

The pattern of transport costs in Europe led to patterns of highly commercial oriented areas and areas that remained agricultural. Fox's discusses 'two societies' that:

> …gave rise to conflicting attitudes toward social organization. The land-based states were generally organized in orderly and rigid bureaucratic hierarchies…By contrast, the members of the commercial community, lacking any firm territorial foundation, were compelled to operate by common consent, and to order their relations by mutual agreement, often arrived at through parliamentary procedures or diplomatic exchanges. These divergent patterns of thought and practice were reflected in the institutions that grew up in the two different types of society and have continued to figure importantly in conflicts between them ever since (Fox 1991, 1-2).

Tilly (1994) later says essentially the same thing: ‘Early paths affected later developments. If a state began by means of brute force conquest in rural regions, its successors generally exploited and cramped the cities in its midst. If, in contrast, merchants and cities lay at a state’s origins, cities and citizens usually enjoyed a measure of autonomy or at least representation’ (12).

Similarly, the historian Frederic C. Lane (1950) identifies ‘two types of organization….profit-oriented activities of business and the power–oriented activity of government….the buying, selling, and calculation of engineering costs in a business enterprise and the military action, the policing, and the judicial procedures employed by government….the new goods and services created by business enterprise and the emergence of new laws and empires through the actions of governments’ (p. 20). These descriptions of ‘two different types of society’ share vocabulary that is remarkably similar to descriptions by many others concerning the characteristics of agricultural versus commercial cultures, with concepts related to hierarchy, force and territory describing agricultural societies and concepts such as cooperation, flexibility, and industriousness characteristic of commercial societies.

The pattern of high and low transport costs had led important patterns of more and less commercial areas at the dawn of the Industrial Revolution and the period of state formation in Europe. This pattern would become amplified by both of these processes, deepening the divide between rich, commercially oriented regions of Europe and those areas that lacked commerce and numerous urban areas. We will first consider the case of state formation in Europe, where urbanization and commerce patterns led to different spatial patterns of political fragmentation, centralization, and commercial orientation. Chapter 8, Section then considers global patterns of political fragmentation and their effect on global development.

Cities and State Formation

Rokkan (1975) has gone further than many in considering the effects that the pattern of commercial cities had on state formation in Europe. Although he considers other factors, his focus on what he calls the ‘city-studded center’ of Europe, the band of cities stretching between the Low Countries, Hansa area, and northern Italy, bears close resemblance to Fox. Rokkan builds on the common observation that the city-studded center was highly fragmented because of the economic strength and political

intricacies of the numerous cities. To the west and east of this area, centralization was possible. But the process and outcomes were very different, as the West had a significant amount of commercial cities due to its coastal location, whereas in the East there was less economic activity and statemaking was economically hobbled.

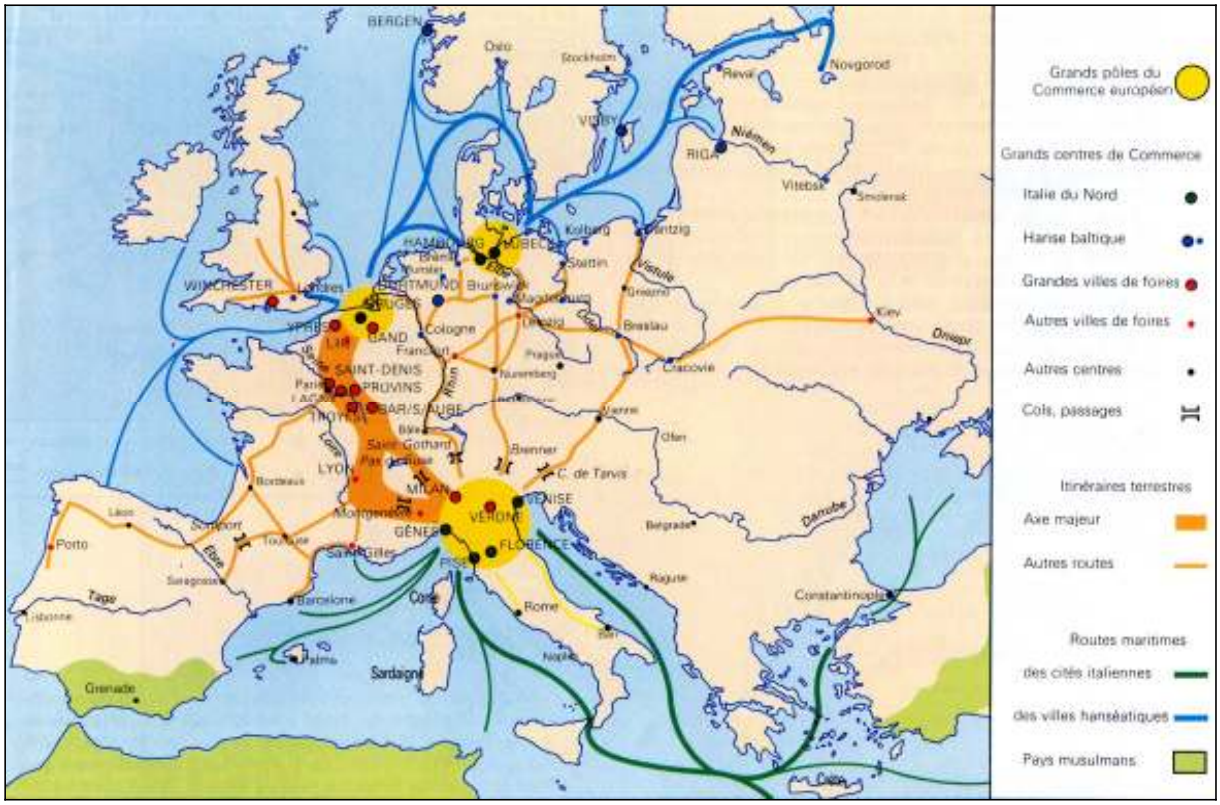
Gellner (1997, 50-58), for the same reasons, likewise divides Europe into three zones[155] on a west to east axis, and notes that the extreme fragmentation of the center caused it to unify last. He notes that the Western states formed along lines very close to ethnic and linguistic barriers; much later the extremely fragmented center would likewise coalesce around linguistic groups. In the East, however, under the empires and then in the struggle of the nations and states, linguistic and ethnic groups were constantly swallowed up by other groups. This supports Rokkan's view and equally importantly Fox's idea of the territorial nature of states with fewer commercial cities and also the relative ease with which inland states and nations can be dominated by neighboring states.

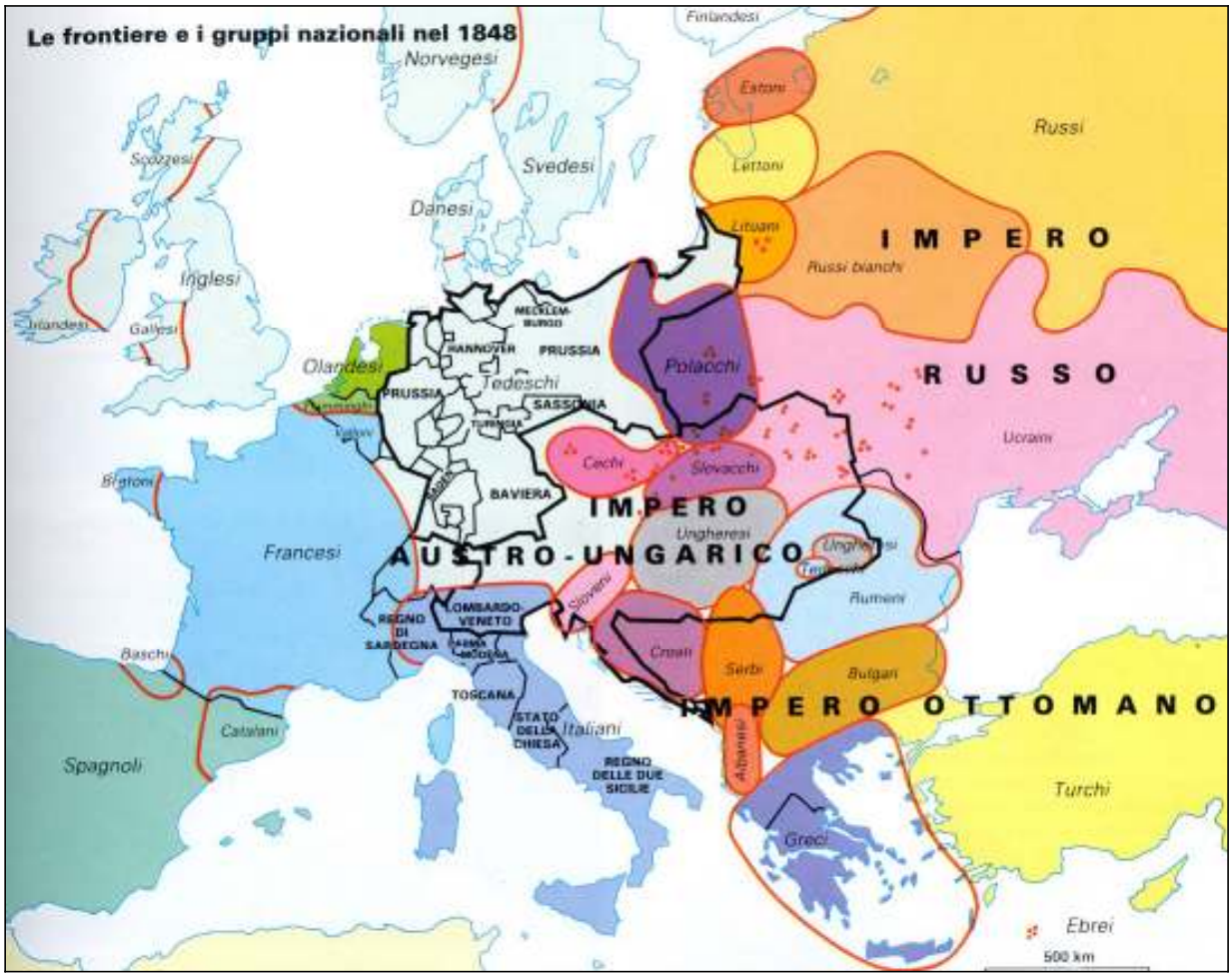
Below are two maps (Figure B-15 and Figure B-16) that in many ways sum up the argument of this section. Figure B-15 shows how early Europe's city-studded center began to form, at least as early as the thirteenth century. The pattern of cities stretching between the three poles of water-based commerce remained essentially the same until today. The effects Rokkan asserts are clear in 1848 in Figure B-16

Figure B-15 (top of next page). Thirteenth Century Commerce in Europe
Source: Chaliand and Rageau, (1989, 51).

Figure B-16 (bottom of next page). European Borders and National Groups in 1848
From West to East: Moderate-Consolidation → Extreme-Fragmentation → Extreme-Consolidation.
Source: Vidal-Naquet and Bertin (2000, 231).

[155] Gellner (1997) divides the eastern zone again, into one zone which went through 'a period of Bolshevism' which can be still further divided into one area which experienced Bolshevism for forty years and another for seventy years (56). However, Gellner's main tripartite division is essentially identical to that of Rokkan.


BERGEN
Oslo
Stockholm
Novgorod
Reval
VISBY
RIGA
Niémen
Vitebsk
Smolensk
Kolberg
Danzig
HAMBURG
BREMEN
Stettin
Vistule
WINCHESTER
Londres
BRUGES
Magdebourg
Breslau
Kiev
YPRES
GAND
Cologne
Francfort
Prague
Dniepr
SAINT-DENIS
PRUVINS
Nuremberg
Cracovie
Paris
Meuse
PARIS/SAUBE
TROYES
Vienne
Bâle
Saint-Gothard
Brenner
Ofen
LYON
C. de Tarvis
Bordeaux
MILAN
VENISE
Lisbonne
Montgenèvre
VÉRONE
Belgrade
Danube
Porto
GÊNES
FLORENCE
Saint-Gilles
Ebre
Saragosse
Ragusa
Tage
Barcelone
Corse
Rome
Constantinople
Palma
Sardaigne
Naples
Grenade
Grands pôles du Commerce européen
Grands centres de Commerce
Italie du Nord
Hanse baltique
Grandes villes de foires
Autres villes de foires
Autres centres
Cols, passages
Itinéraires terrestres
Axe majeur
Autres routes
Routes maritimes
des cités italiennes
des villes hanséatiques
Pays musulmans


Le frontiere e i gruppi nazionali nel 1848
Norvegesi
Finlandesi
Estoni
Russi
Scozzesi
Svedesi
Lettoni
Danesi
Lituani
IMPERO
Inglesi
Russi bianchi
Irlandesi
Gallesi
MECKLEM-BURGO
HANNOVER
PRUSSIA
Polacchi
RUSSO
Olandesi
PRUSSIA
Tedeschi
SASSONIA
Ucraini
Cechi
Slovacchi
Belgi
BAVIERA
IMPERO
Ungheresi
Francesi
AUSTRO-UNGARICO
Rumeni
LOMBARDO VENETO
REGNO DI SARDEGNA
Sloveni
Baschi
Croati
Serbi
Bulgari
TOSCANA
IMPERO OTTOMANO
Catalani
STATO DELLA CHIESA
Italiani
Albanesi
Spagnoli
REGNO DELLE DUE SICILIE
Turchi
Greci
Ebrei
500 km

Significantly, these maps are from different sources and neither was made to support the ideas asserted here.

Figure B-15 is suggestive of the ideas of Fox, while Figure B-16 (black lines are state boundaries, red lines are ethnic boundaries) is highly suggestive of the theories of Rokkan, Fox, and Gellner. Furthermore, there is roughly a five hundred year difference in the maps, yet the pattern of commercial cities evident in the 1200s persists in 1848, suggesting the long-term effects of geographic variables on the location of cities, as well as the possibility that path dependent and positive feedback effects are important aspects of the dynamics of development previously discussed.

Ignoring ethnic boundaries for a moment (in Figure B-16), the fragmentation of state borders is clear in the 'city-studded center', the region stretching between the three poles of commerce shown in Figure B-15 (the Low Countries, the Hanseatic league, and the northern Italian kingdoms, duchies and communal republics). The fragmentation is so great in Germany that most of it does not show on the map as it is of much too fine a detail. Rokkan's point about the early formation of strong states in the West is evident. That these states had good access to the sea is obvious, leading to significant numbers of commercial cities such as Lisbon, Barcelona and Bordeaux, yet fewer than in what would become Germany and northern Italy. This allowed the West to be economically vibrant because some trade was occurring, but not overly fragmented by competing commercial cities; Spain and France are good examples, both unifying early and becoming both militarily/economically powerful and territorially aggressive. Gellner's point that the boundaries in the West crossed relatively few linguistic and ethnic boundaries (with obvious exceptions such as the Basque Country, Catalonia, Brittany, and Scotland) is also evident in Figure B-16.

To the east of the center, economies were more backward with relatively few commercial cities; states unified somewhat later and were almost always economically weak compared to the West; although they were often territorially aggressive their military capacity was hindered because of a lack of wealth from commercial cities. Those states to the east that had some commercial cities, such as Russia with the riverine cities of Novgorod and (at times) Kiev, and that later developed coastal St. Petersburg precisely to reap the benefits the West reaped from its commercial cities, were relatively more powerful. Those that had few commercial cities disappeared altogether, swallowed up by other powers. Moravia is a good example of the fates of most would-be Eastern states. Once an empire itself, Moravia

was later absorbed by Bohemia, which in turn was swallowed by the Hapsburgs of Austria, then formed part of Czechoslovakia, was taken by Germany, and finally ended up as part of the Czech republic, but was never sovereign again.[156] In 1848 in eastern Europe empires had swallowed countless linguistic and ethnic groups, many of which would seldom achieve state structures similar to those in western Europe even when eastern Europe experienced state formation. This is in part a result of the economic logic of territoriality in inland areas with few opportunities of increased wealth or military strength except through expansion and consolidation of more territory.[157]

The West instead followed 'A middle path, combining considerable concentrations of both capital and coercion, [which] promoted substantial, rich states'; the 'Coercion-intensive [east], and capitalized-coercion [west] paths of state transformation differed significantly from each other' (Tilly 1994, 12). 'States in the West generally depended upon a more conditional and reciprocal relationship between rulers and numerous social groups (nobles, merchants), while in the East despotism was relatively undiluted' (Stephen 2000, 8). The only difference in these statements and Rokkan's ideas is that Tilly and Stephen do not consider the fragmented center.

To summarize, simply looking at the number of commercial cities in each area, a function of coastal access, rivers, and agricultural productivity, suggests the nature and economic potential of states, as well as the timing of their formation. Prussia is an example of a territorial power more successful at aggression than Moravia was; when it dominated the commercial cites to the west it had an economic potential unequaled in the world except by the United States, yet maintained the territorial traits of other eastern inland states (Shirer 1960). This would lead it into conflicts of unprecedented aggressiveness and destruction, with the territorial nature especially clear in the Franco-Prussian and Second World War.

Putnam's Social Capital and Cities

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[156] Of course examples of this can be found in the West, but it seems to have been far more prevalent in the East.

[157] Bairoch (1993, 146), like others, points out that the word 'slave' stems from the frequent conquering and enslavement of the Slavic peoples; this again supports the degree to which the inland East developed in a fundamentally different way than the coastal regions in the West.

Putnam, in keeping with the view here, asserts that social capital is developed over very long time periods and that the greatest disruption to its formation is rule by autocratic government. However, Putnam's ideas differ sharply on one key point. He asserts that social capital is not affected by cities. He supports this assertion in only one paragraph and one endnote (118 and 227) and states 'we found no association of any sort' between measures of cities and his regional performance measurements based on social capital. Considering the meticulousness with which Putnam constructs the rest of his argument, it is surprising that such a potentially relevant factor such as cities is dismissed essentially out of hand.

There are three major flaws in the information Putnam uses to come to this conclusion. His assertion is based on: (1) too little information (one simple measure of urbanization); (2) from the wrong time period. He uses a single measure from 1986, when he asserts that social capital has roots from as far back as the thirteenth century, and (3) the wrong type of information. Putnam makes a mistake that many make in discussing cities, that of confusing urbanization (a percentage) with gross number of cities. These two measures have different implications. Urbanization is based on the ratio of rural to urban population; there are a number of problems with this figure including the fact that urbanization rates do not always correlate well with economic factors—there are highly urban societies that are very poor and very rich.[158] Urbanization *rates* (but not total number of cities) vary far less than was once thought through history (Bairoch 1993, 142-144); this and the fact that urbanization rates are based on percentages that are highly sensitive to local agricultural practices and social customs more than broad economic patterns make them less important indicators of socioeconomic structure than many have asserted.

More pertinent in many ways for understanding the socioeconomic and political impact of cities is the *total* number of cities in an area, especially if the level of commerce in these is known to be high, as it was in northern Italy (Duggan 1995, 37-38). These must be looked at not just recently but through the time period that Putnam

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[158] For example, Egypt in 1947 was more urbanized than Sweden and France if percent of population in cities over 100,000 is used as the measure of urbanization (Davis and Golden 1955, 16). This source, and the entire 1955 *Economic Development and Cultural Change,* volume 3, discusses these and related issues; Bairoch (1988), discusses urbanization in depth, especially chapter 30 for urbanization and economic performance in developing countries.

asserts was key to the formation of social capital, at least back to the fourteenth century. This is done in Figures B-19 through B-23. These maps show the striking correlation of early commercial cities with areas of later industrialization and high GDP per capita. Furthermore, the first four maps are from three unrelated sources, none of which are concerned with social capital.

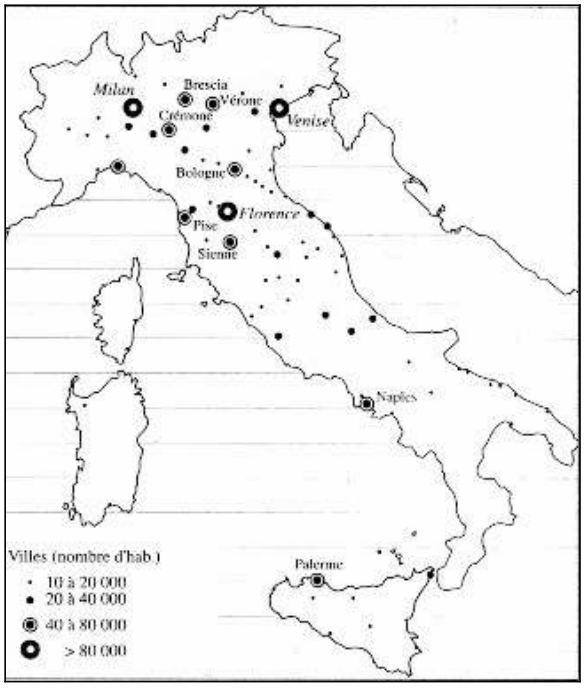

Figure B-17 Italian Cities in the Fourteenth Century
Source: Bardet and Dupâquier (1997, 493).

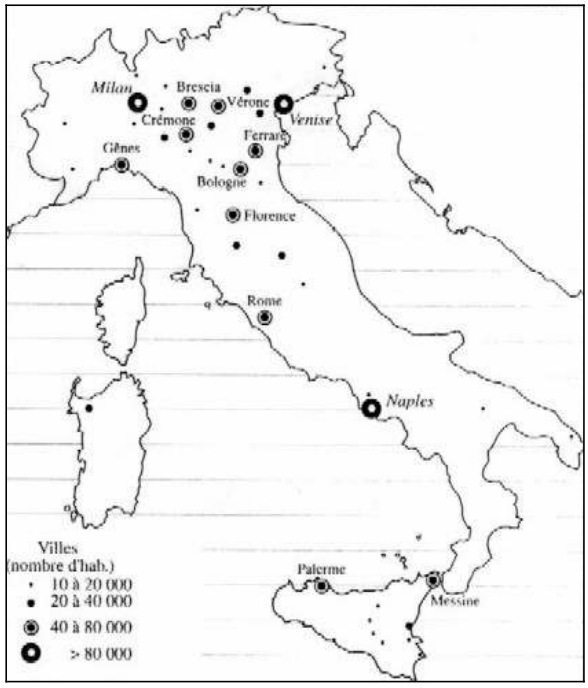

Figure B-19 Italian Cities in the Sixteenth Century
Source: Bardet and Dupâquier (1997, 496).

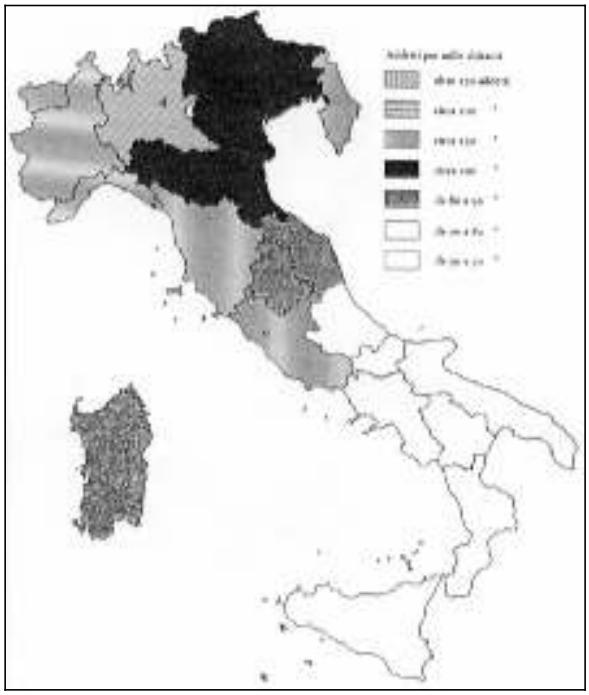

Figure B-18 Distribution of Industrial Activity in Ita1y in 1927
Source: Coppola (1997, 287)

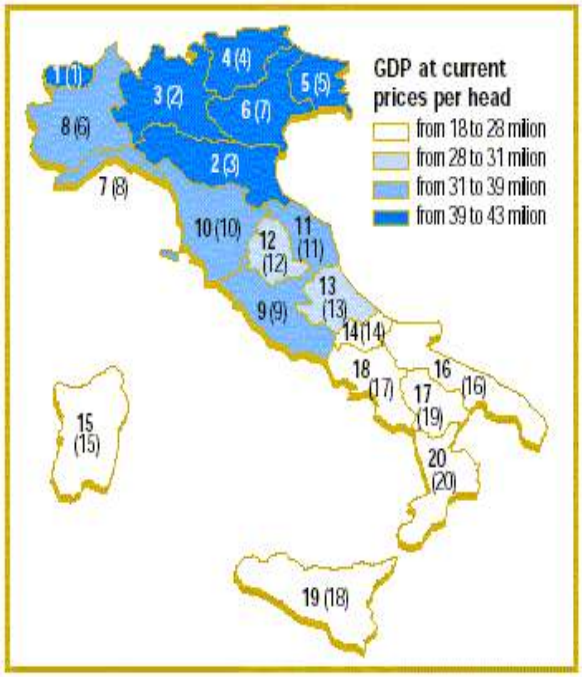

Figure B-20 Italy, 1996 GDP Per Capita Ranked by Region
(Numbers in parenthesis are ranking from previous year).
Source: ISTAT (1999)

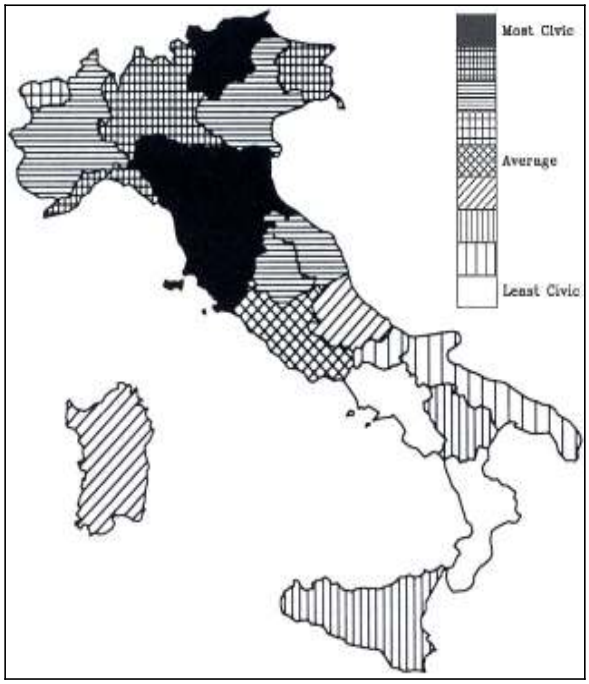

Figure B-21 Social Capital in Italy (~1972~1992)
Source: Putnam (1993)

Figure B-17 shows the total number and sizes of cities with over 10,000 inhabitants in the fourteenth century. There is a striking correlation of these to Putnam's measures of social capital in Figure B-21. But the correlation of fourteenth century commercial cities to industrialization in 1927 in Figure B-18[159] and current GDP in Figure B-20 are equally or more striking. Simply put, where there were cities in the fourteenth century there was early industrialization, as well as high economic performance and high social capital today. Figure B-19 shows that the pattern of urbanization stayed essentially the same through the centuries (There are fewer overall cities because of the plagues. Comparison with a modern map shows that the North to this day has a significantly greater number of medium to large cities scattered throughout than does the South).

In a related argument, Putnam strongly asserts that social capital came before economic activity and is the stronger determinant of political and economic performance (Putnam 1993, 152-158). But again, the dates he uses (from 1900 to the present) are not the same dates he suggests were key in the formation of social capital.

[159] This is a relatively early date for late-industrializing Italy. Modern maps show much the same distribution with only some differences in ranking between regions and slight creep to the South; that modern maps show little change in industrialization shows how it takes decades and centuries to see these processes unfold, a point of course very frustrating for those in charge of attempting to stimulate growth in southern Italy in the belief change can easily occur in shorter time spans.

The problem with this is that the number of commercial cities in northern Italy was clearly extraordinarily high as early as the fourteenth century. Putnam's assertion that social capital precedes economic activity implies that there were *cultural* traits as far back as at least the thirteenth or twelfth century (or further back; they would have to precede the well-established development of numerous economically vibrant cities) that caused the commerce and economic vitality of northern Italy to begin, and that have lasted until today.

It seems that a more satisfactory explanation is that the high agricultural potential of the Po and Arno valleys nurtured the growth of populations that, combined with the high water transport potential of these rivers and the Ligurian, Tyrrhenian, and Adriatic Seas, promoted the development of commercial cities that in turn stimulated the development of institutions, starting a virtuous cycle of economic growth and further institutional development. Otherwise, northern Italians have simply had some unexplained innate superiority of political organization for almost a thousand years. The circularity of social capital arguments is similar to the circularity of core-periphery arguments; the explanations certainly sound plausible, yet the conclusions seem dangerously close to the assumptions. Something has to cause the initial formation of higher than normal levels of social capital just as something must explain the growth and location of the core for these arguments to avoid circularity. Effects of transport costs offer a simple explanation for the rise and location of a city-studded core and patterns of institution provoking commerce, and help explain how vicious and virtuous cycles first begin.

The same problems of timing in Putnam's assertion that social capital preceded economic causes in Italy applies to many similar ideas, including the most famous of all, those of Weber. Suggesting Protestantism somehow caused economic growth in the areas of Protestantism suffers from the simple fact that the commercial growth of cities in the future Protestant area had been occurring gradually for centuries in the Hansa area and associated trading cities in England, the Low Countries, Switzerland, and parts of France. The patterns of Protestantism and commerce are not similar enough to prove commerce caused the rise and spread of Protestantism, although they are suggestive that this was the case in many areas (Wuthnow 1989), and they are similar enough to have caused Weber's idea to offer a seductively simple explanation. However, when timing and commercial cities are considered the argument that commerce sometimes brought about the social conditions, namely the rise of a

substantial bourgeois population due the growth of commercial cities that led to a change in values that eventually caused a split from a distant Roman church, seems more plausible. Bourgeois values have remained today throughout the city-studded center regardless of religion, as evidenced by one of the single most productive economic areas in the world, much more productive than many protestant areas of Europe: Catholic northern Italy. Weber's thesis is convincing, but it is the areas of commercial cities and the cultures that developed from them, regardless of religion, that have an uncommon work ethic.

Conclusion

The purpose of this appendix is to provide further discussion of some of the empirical example discussed in Chapters 5-8. The appendix also shows how future empirical work might proceed, and how the increase in empirical data from some fields are able to help in understanding the spatial distributions resulting from antecedent and initial conditions in other fields.

APPENDIX C
EXAMPLE OF CLUSTER ANALYSIS

In Chapter 6 spatial autocorrelation is mentioned as a type of boundary condition problem and as a problem for empirical statistical studies (because analysis of spatial autocorrelation suggests there are far fewer cases for statistical analysis than are commonly used). This addendum consists of the exploration of a possible method for dealing empirically with this problem that helps further demonstrate the degree of spatial autocorrelation in development indicators, and shows a possible direction for future research.

The goal of identifying the degree and scale of spatial autocorrelation in data can be approached in a number of ways. One is through standard measures of spatial autocorrelation in data (Moran's I, Geary's C). Another is through the consideration of known historical diffusion and interactions through trade and migration between countries and world regions. The pros and cons of these methods mirror the wider debate on the pros and cons of statistical versus qualitative methods more generally in the social sciences.

However, a third possibility, cluster analysis, might allow for the data developed for statistical manipulation, yet suffering from a high degree of spatial autocorrelation, to be used in a way that is nevertheless more formal than qualitative analysis.

Although widely used in biology, physical geography, marketing, sociology and psychology, cluster analysis has not been widely used in the social sciences most similar to development studies, where it is considered a relatively experimental and undeveloped method of analysis (T.W. Chan 1999; McMenamin 2003, 13). Recently, however, several political science papers have used cluster analysis as a means to more precisely test ideas associated with the influential *Three Worlds of Welfare Capitalism* by Gøsta Esping-Andersen (Edwards 2003; McMenamin 2003). These papers not only demonstrate the utility of cluster analysis in logically grouping cases that vary along multidimensional planes, but also demonstrate its power to allow for

more rigorous and meaningful comparative political science. Crucially, the identification by Esping-Andersen of regions with certain factors leading to different welfare outcomes is very similar to the goal of this thesis, which is to identify the factors that are important in causing a number of world-regional development 'regimes'. S. Chan (2001) uses cluster analysis in a similar way for comparison of development trajectories of Southeast Asian and Latin American countries. These recent works demonstrate the utility of cluster analysis as a tool of comparative political economy as well as provide guidance for using the technique.

Cluster analysis proceeds by clustering based on different sets of variables (selected based on theoretical concerns). The resulting clusters are then analyzed according to the factors that were used. In this case, cluster analysis is performed across factors from different representative theoretical arguments from previous econometric studies. Also, clusters will be performed on single sets of *related* factors, such as only geographic factors, and only institutional factors, then comparing their verisimilitude. The clusters can be judged in several different ways.

Using standardized data, the distance between the 'nodes' where various cases cluster can be read as the amount of variation or R^2 explained by the creation of that particular cluster.

One advantage of cluster analysis over other methods is that 'Cluster analysis approaches the problem of determining similarities and differences among societies more directly [than factor analysis methods], namely by determining the multidimensional distances between various societies and then picking out those groups of societies within which the distances are relatively small' (Maxwell, Pryor and Smith 2002).This direct method of determining similarities and differences allows for the interpretation of the results from cluster analysis by gauging the extent to which different sets of variables cause the formation of clusters that correspond to real world geography – that is, clusters that mirror world regions, and still more precisely, that cluster contiguous countries. Chapter 6 shows that clusters based on geographical, institutional and economic measures all correspond closely with world regions derived from historical analysis. The two different methods support each other's conclusions as to the number, size and delineation of world regions.

To make sure clustering is robust, several measures can be used. First, the cophenetic correlation coefficient measures the degree to which the clustering algorithm is able to cluster cleanly. Furthermore, the existence of numerous distance

measures and clustering strategies can be taken advantage of; each cluster analysis can be run under alternative distance measures and clustering strategies. Preliminary cluster analysis on the development data from (or similar to) that discussed in Chapter 7 shows both high cophenetic correlation coefficients and that the clusters that are formed are relatively stable using alternative methods. This suggests that the clustering methods are not 'forcing' the cases into clusters somewhat randomly, but forming clusters that represent real differences on the dimensions being measured.[160]

Crucially, because case identity is maintained in cluster analysis, the clusters and anomalies can form the basis for comparative analysis. This proceeds in the same way as normal comparative political economy, with the advantage that the cases used in comparison are not chosen by the researcher but generated form the data, reducing the subjectivity of case selection inherent in normal comparative analysis.

Preliminary cluster analysis has shown that the data used in development studies create clusters that are close to the world-regions identified from historical considerations above. Moreover, the methods used in S. Chan (2001) Edwards (2003) and McMenamin (2003) seem appropriate for analyzing these clusters.

An example of cluster analysis is included below. As noted before, cluster analysis as a technique for comparative political economy is in an experimental stage. The main points the example below shows is first that using the data that has been used for past regression analyses, clusters similar to real world-regions form. This is good in the sense that it suggests the data is accurately measuring some important characteristics of the cases that form clusters; however, it is bad from a statistical standpoint, further evidence that the statistical assumption of the independence of cases is unlikely to be supported.

The clusters that form are not forced to use contiguous countries. Where countries from different world regions cluster, we know from historical analysis whether these countries are historically related. If they are not, then we can attempt to identify what other factors these countries have in common that leads them to cluster.

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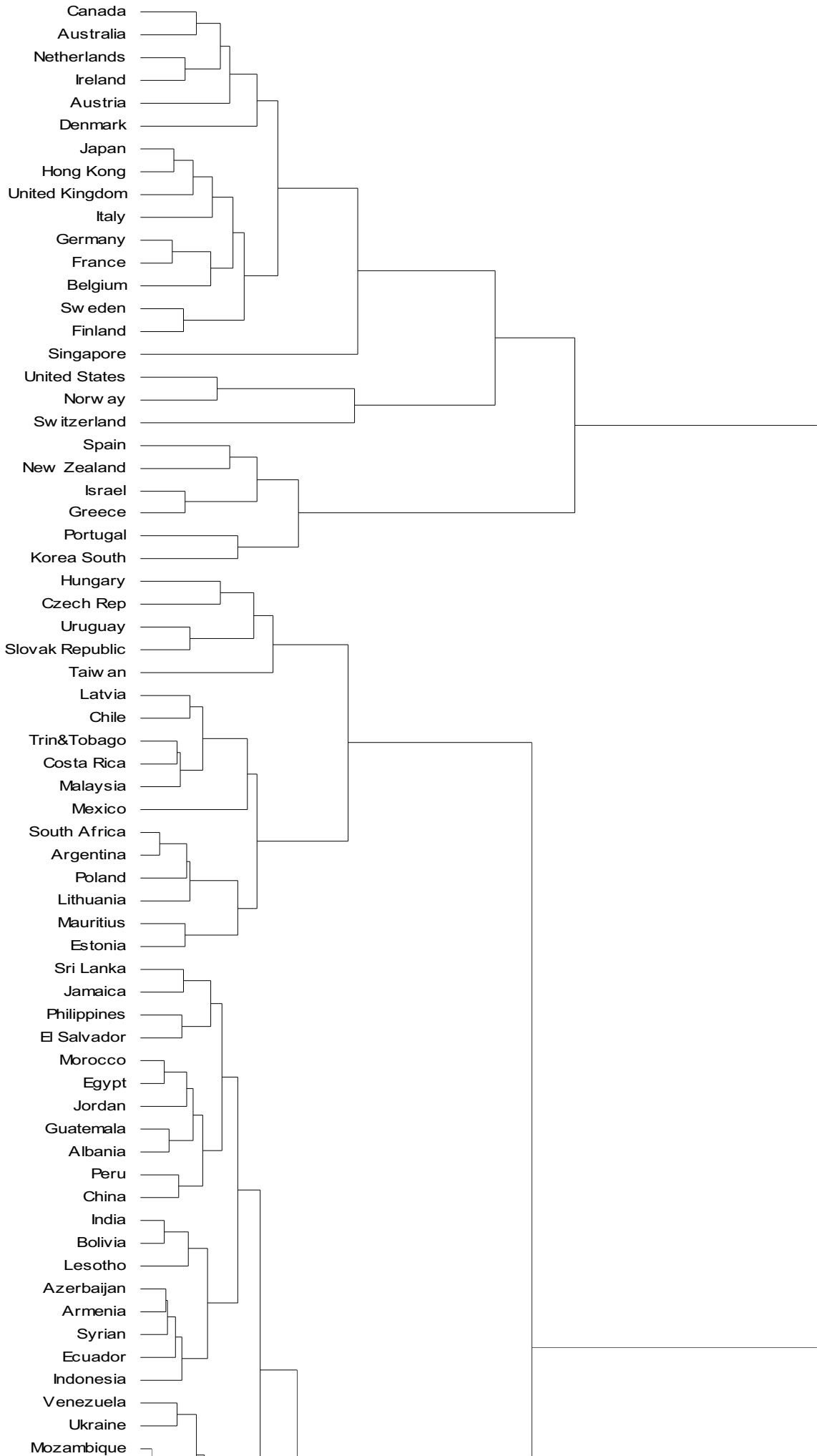
[160] If it is deemed worth pursuing, the quality of clusters can be increased through combining hierarchical clustering and k-means clustering. This is achieved by clustering initially using the more stable hierarchical clustering methods. Then the centroids of the desired clusters are used as the base to initiate k-means clustering, which allows for the changing of cases from one cluster to another through iterations but can get trapped into unstable loops. This method achieves the stability of hierarchical clustering with the ability of k-means clustering to 'fine tune' clusters. Because systematic *comparison* more than perfect clusters is the goal here, this might not be worthwhile.

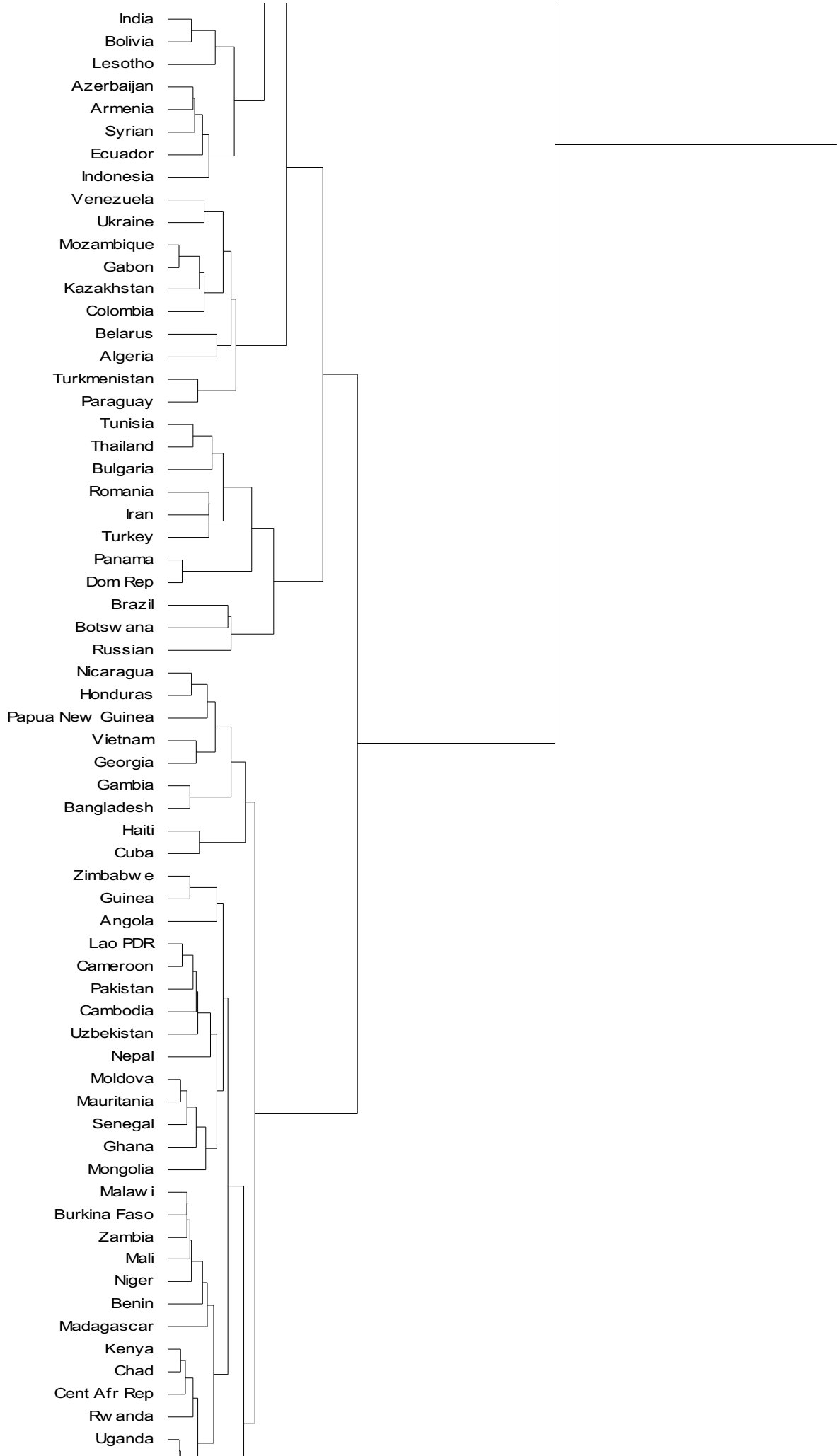
By changing the mix of factors used for clustering, we can see which mixes give a more realistic set of clusters. While not easy to interpret, this might at least aid in differentiating the explanatory value of competing development theories.

This technique does not offer a strict method of comparison, such as comparing coefficients and significance levels in regression analysis, yet it does offer a way to maintain the visibility of cases, allowing for comparative historical consideration of the logic of arguments that use the data that form the clusters. Crucially, it has the advantage of allowing for the consideration of a much larger number of factors and cases than is feasible using comparative case studies alone. Multiple datasets across up to 150 cases or more form the basis for these comparisons. In this sense, they are much more empirically grounded and less subjective than normal comparative analysis. While by no means perfect, use of this technique in this way does offer a somewhat new and different perspective of socioeconomic arguments for development differences and similarities.

First, to show the degree to which clustering corresponds logically to real world-regions, we can cluster using two measures argued to be important in the 'geography' literature, and from the 'institutions' literature. The sample cluster below uses measures adapted from Sachs on the degree of ocean transport potential and ocean navigable river transport potential countries have, combined with the institutional measure by Kaufman et al. (2003). A socialist dummy is also added to ease comparison of economies (It is difficult to meaningfully compare communist and non-communist countries; to avoid using a dummy variable, in more recent clusters we instead use a Gini coefficient of inequality; this more subtly captures much of the socialist dummy variable).

Figure C-1 Sample Cluster Analysis
(extends over the next three pages)


Canada
Australia
Netherlands
Ireland
Austria
Denmark
Japan
Hong Kong
United Kingdom
Italy
Germany
France
Belgium
Sw eden
Finland
Singapore
United States
Norw ay
Sw itzerland
Spain
New Zealand
Israel
Greece
Portugal
Korea South
Hungary
Czech Rep
Uruguay
Slovak Republic
Taiw an
Latvia
Chile
Trin&Tobago
Costa Rica
Malaysia
Mexico
South Africa
Argentina
Poland
Lithuania
Mauritius
Estonia
Sri Lanka
Jamaica
Philippines
El Salvador
Morocco
Egypt
Jordan
Guatemala
Albania
Peru
China
India
Bolivia
Lesotho
Azerbaijan
Armenia
Syrian
Ecuador
Indonesia
Venezuela
Ukraine
Mozambique


India
Bolivia
Lesotho
Azerbaijan
Armenia
Syrian
Ecuador
Indonesia
Venezuela
Ukraine
Mozambique
Gabon
Kazakhstan
Colombia
Belarus
Algeria
Turkmenistan
Paraguay
Tunisia
Thailand
Bulgaria
Romania
Iran
Turkey
Panama
Dom Rep
Brazil
Botsw ana
Russian
Nicaragua
Honduras
Papua New Guinea
Vietnam
Georgia
Gambia
Bangladesh
Haiti
Cuba
Zimbabw e
Guinea
Angola
Lao PDR
Cameroon
Pakistan
Cambodia
Uzbekistan
Nepal
Moldova
Mauritania
Senegal
Ghana
Mongolia
Malaw i
Burkina Faso
Zambia
Mali
Niger
Benin
Madagascar
Kenya
Chad
Cent Afr Rep
Rw anda
Uganda

Other experimental cluster analyses have been done using different types of data. (For example, all six of the dimensions of institutional variation have been used, combined with a measure of the degree of religious, ethnic, and linguistic fractionalization (from Alesina et. al. 2003), theorized by some to create less stable institutions and greater rent seeking at the national level. The results are similar to Figure C-1, although with interesting differences in the resulting clusters.)

APPENDIX D
OLD WORLD CROPS IN THE NEW WORLD

In Chapter 6 Acemoglu, Johnson and Robinson 2002 is used in an example of how relevant mapped data can aid in better understanding complex development arguments. In particular, it is argued that mapped data helps make clear a fundamental flaw in the AJR 2002 argument that institutions 'trump' geography in explaining development outcomes, i.e., that 'geography' was *not* held constant in the period of colonization.

As discussed in Chapter 6, Acemoglu, Johnson and Robinson consider as 'geography' relatively unchanging factors such as latitude, soils, or climate. But one of the most important intermediary geographical factors between such fixed factors and humans is *biogeography*. Biogeography experienced quantitatively its most radical change since the Pleistocene, and qualitatively perhaps its most drastic change ever - there has likely never been a similar, and so drastic, shift in the distribution of biota on a global scale in such a short time period. There have been mass *extinctions*, but never mass, virtually simultaneous, and global *introductions* of new biota on such a global scale as occurred with the 'Columbia Exchange'. Geography, far from being held constant during the period of colonization, went through one of its most abrupt and far reaching changes ever. Furthermore, the particular aspect of 'geography' that changed was one of the geographic factors most fundamentally important to humans, that related to food production. This appendix lists the incredible number of Old World, largely temperate-suitable, often high-yield food producing flora that suddenly became available in the New Worlds; the change in regional food production capability was especially radical in the New World temperate zones.

Any claim that 'geography' did not change during the time period of colonization could not be more wrong. Furthermore, the change is in the 'geography' most linked to the means of production and institutional development of the pre-industrial period. The 'Columbian exchange' (Crosby 1972; see also Crosby 1986) allowed for the temperate areas of the 'New Worlds' of the Americas and Oceania (as well as the formerly isolated southern cone of Africa) to abruptly change from some of the least amenable to food production in the world, and with some of the lowest population

densities in the world, to becoming the highest food producing regions in the world in a geological blink of an eye. Below is a list (adapted from Janick 2003) of the major centers of Afro-Eurasian food centers and their major crops, a great many of them suitable and many ideal for temperate regions, which suddenly became available in the New Worlds. Seeing this list is important for grasping the scale of the change in food production capacity in non-Eurasian temperate regions, and how the AJR natural experiment is based on a flawed premise because of a lack of visualization of geographic factors.

I. CHINESE CENTRE:

136 endemic plants are listed,

Cereals and Legumes
1. Broomcorn millet, *Panicum miliaceum*
2. Italian millet, *Panicum italicum*
3. Japanese barnyard millet, *Panicum frumentaceum*
4. Kaoliang, *Andropogon sorghum*
5. Buckwheat, *Fagopyrum esculentum*
6. Hull-less barley, *Hordeum hexastichum*
7. Soybean, *Glycine max*
8. Adzuki bean, *Phaseolus angularis*
9. Velvet bean, *Stizolobium hassjoo*

Roots, Tubers, and Vegetables
1. Chinese yam, *Dioscorea batatas*
2. Radish, *Raphanus sativus*
3. Chinese cabbage, *Brassica chinensis, B. pekinensis*
4. Onion, *Allium chinense, A. fistulosum, A. pekinense*
5. Cucumber, *Cucumis sativus*

Fruits and Nuts
1. Pear, *Pyrus serotina, P. ussuriensis*
2. Chinese apple, *Malus asiatica*
3. Peach, *Prunus persica*
4. Apricot, *Prunus armeniaca*
5. Cherry, *Prunus pseudocerasus*
6. Walnut, *Juglans sinensis*
7. Litchi, *Litchi chinensis*

Sugar, Drug, and Fiber Plants
1. Sugarcane, *Saccharum sinense*
2. Opium poppy, *Papaver somniferum*
3. Ginseng, *Panax ginseng*
4. Camphor, *Cinnamomum camphora*
5. Hemp, *Cannabis sativa*

II. INDIAN CENTRE:

This area has two subcentres. A. Main Centre (Hindustan): Includes Assam and Burma, but not Northwest India, Punjab, nor Northwest Frontier Provinces. In this area, 117 plants were considered to be endemic.

Cereals and Legumes
1. Rice, *Oryza sativa*
2. Chickpea or gram, *Cicer arietinum*
3. Pigeon pea, *Cajanus indicus*
4. Urd bean, *Phaseolus mungo*
5. Mung bean, *Phaseolus aureus*
6. Rice bean, *Phaseolus calcaratus*
7. Cowpea, *Vigna sinensis*

Vegetables and Tubers
1. Eggplant, *Solanum melongena*
2. Cucumber, *Cucumis sativus*
3. Radish, *Raphanus caudatus* (pods eaten)
4. Taro, *Colocasia antiquorum*
5. Yam, *Dioscorea alata*

Fruits
1. Mango, *Mangifera indica*
2. Orange, *Citrus sinensis*

3. Tangerine, *Citrus nobilis*
4. Citron, *Citrus medica*
5. Tamarind, *Tamarindus indica*

Sugar, Oil, and Fiber Plants
1. Sugar cane, *Saccharum officinarum*
2. Coconut palm, *Cocos nucifera*
3. Sesame, *Sesamum indicum*
4. Safflower, *Carthamus tinctorius*
5. Tree cotton, *Gossypium arboreum*
6. Oriental cotton, *Gossypium nanking*
7. Jute, *Corchorus capsularis*
8. Crotalaria, *Crotalaria juncea*
9. Kenaf, *Hibiscus cannabinus*

Spices, Stimulants, Dyes, and Miscellaneous
1. Hemp, *Cannabis indica*
2. Black pepper, *Piper nigrum*
3. Gum arabic, *Acacia arabica*
4. Sandalwood, *Santalum album*
5. Indigo, *Indigofera tinctoria*
6. Cinnamon tree, *Cinnamomum zeylanticum*
7. Croton, *Croton tiglium*
8. Bamboo, *Bambusa tulda*

III. INDO-MALAYAN CENTRE:

Fifty-five plants

Cereals and Legumes
1. Jobs tears, *Coix lacryma*
2. Velvet bean, *Mucuna utilis*

Fruits
1. Pummelo, *Citrus grandis*
2. Banana, *Musa cavendishii, M. paradisiaca,*
H. sapientum
3. Breadfruit, *Artocarpus communis*
4. Mangosteen, *Garcinia mangostana*

Oil, Sugar, Spice, and Fiber Plants
1. Candlenut, *Aleurites moluccana*
2. Coconut palm, *Cocos nucifera*
3. Sugarcane, *Saccharum officinarum*
4. Clove, *Caryophyllus aromaticus*
5. Nutmeg, *Myristaca fragrans*
6. Black pepper, *Piper nigrum*
7. Manila hemp or abaca, *Musa textiles*

IV. CENTRAL ASIATIC CENTRE:

Includes Northwest India (Punjab, Northwest Frontier Provinces and Kashmir), Afghanistan, Tadjikistan, Uzbekistan, and western Tian-Shan. Forty-three plants are listed for this centre, including many wheats.

Grains and Legumes
1. Common wheat, *Triticum vulgare*
2. Club wheat, *Triticum compactum*
3. Shot wheat, *Triticum sphaerocoecum*
4. Pea, *Pisum sativum*
5. Lentil, *Lens esculenta*
6. Horse bean, *Vicia faba*
7. Chickpea, *Cicer arientinum*
8. Mung bean, *Phaseolus aureus*
9. Mustard, *Brassica juncea*
10. Flax, *Linum usitatissimum*
11. Sesame, *Sesamum indicum*

Fiber Plants
1. Hemp, *Cannabis indica*
2. Cotton, *Gossypium herbaceum*

Vegetables
1. Onion, *Allium cepa*
2. Garlic, *Allium sativum*
3. Spinach, *Spinacia oleracea*
4. Carrot, *Daucus carota*

Fruits
1. Pistacia, *Pistacia vera*
2. Pear, *Pyrus communis*
3. Almond, *Amygdalus communis*
4. Grape, *Vitis vinifera*
5. Apple, *Malus pumila*

V. NEAR-EASTERN CENTRE:

Eighty-three species including nine species of wheat

Grains and Legumes

1. Einkorn wheat, *Triticum monococcum* (14 chromosomes)
2. Durum wheat, *Triticum durum* (28 chromosomes)
3. Poulard wheat, *Triticum turgidum* (28 chromosomes)
4. Common wheat, *Triticum vulgare* (42 chromosomes)
5. Oriental wheat, *Triticum orientale*
6. Persian wheat, *Triticum persicum* (28 chromosomes)
7. *Triticum timopheevi* (28 chromosomes)
8. *Triticum macha* (42 chromosomes)
9. *Triticum vavilovianum*, branched (42 chromosomes)
10. Two-row barley, *Hordeum distichum, H. nutans*
11. Rye, *Secale cereale*
12. Mediterranean oats, *Avena byzantina*
5. Quince, *Cydonia oblonga*
6. Cherry, *Prunus cerasus*
7. Hawthorn, *Crataegus azarolus*

V. MEDITERRANEAN CENTRE:

Eighty-four plants are listed for this region including olive and many cultivated vegetables and forages.

Cereals and Legumes

1. Durum wheat, *Triticum durum expansum*
2. Emmer, *Triticum dicoccum* (one of the centres)
3. Polish wheat, *Triticum polonicum*
4. Spelt, *Triticum spelta*
5. Mediterranean oats, *Avena byzantina*
6. Sand oats, *Avena brevis*
7. Canarygrass, *Phalaris canariensis*
8. Grass pea, *Lathyrus sativus*
9. Pea, *Pisum sativum* (large seeded varieties)
10. Lupine, *Lupinus albu*s, and others

Forage Plants

1. Egyptian clover, *Trifolium alexandrinum*
2. White Clover, *Trifolium repen*s
3. Crimson clover, *Trifolium incarnatum*
4. Serradella, *Ornithopus sativus*

Oil and Fiber Plants

1. Flax, *Linum usitatissimum*, and wild *L. angustifolium*
2. Rape, *Brassica napus*
3. Black mustard, *Brassica nigra*
4. Olive, *Olea europaea*

Vegetables

1. Garden beet, *Beta vulgaris*
2. Cabbage, *Brassica oleracea*
3. Turnip, *Brassica campestris, B. napus*
4. Lettuce, *Lactuca sativa*
5. Asparagus, *Asparagus officinalis*
6. Celery, *Apium graveolens*
7. Chicory, *Cichorium intybus*
8. Parsnip, *Pastinaca sativa*
9. Rhubarb, *Rheum officinale*

Ethereal Oil and Spice Plants

1. Caraway, *Carum carvi*
2. Anise, *Pimpinella anisum*
3. Thyme, *Thymus vulgaris*
4. Peppermint, *Mentha piperita*
5. Sage, *Salvia officinalis*
6. Hop, *Humulus lupulus*

VI. ABYSSINIAN CENTRE:

In this centre were listed 38 species. Rich in wheat and barley.

Grains and Legumes

1. Abyssinian hard wheat, *Triticum durum abyssinicum*
2. Poulard wheat, *Triticum turgidum abyssinicum*
3. Emmer, *Triticum dicoccum abyssinicum*
4. Polish wheat, *Triticum polonicum abyssinicum*
5. Barley, *Hordeum sativum* (great diversity of forms)

6. Grain sorghum, *Andropogon sorghum*
7. Pearl millet, *Pennisetum spicatum*
8. African millet, *Eleusine coracana*
9. Cowpea, *Vigna sinensis*
10. Flax, *Linum usitatissimum*

Miscellaneous
1. Sesame, *Sesamum indicum* (basic centre)
2. Castor bean, *Ricinus communis* (a centre)
3. Garden cress, *Lepidium sativum*
4. Coffee, *Coffea arabica*
5. Okra, *Hibiscus esculentus*
6. Myrrh, *Commiphora abyssinicia*
7. Indigo, *Indigofera argente*

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